



Kamov Ka-50 single-seat attack helicopter (Yefim Gordon)

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for trials at 4th Army Aviation Training Centre, Torzhok. In August 1994, the Ka-50 was included in the Russian Army inventory by Presidential decree, judged winner of the fly-off against Mi-28. The Mi-28 was nominally terminated on 5 October 1994 but the competition continued.

Further army evaluation followed when first two of four production Ka-50s were funded in 1994 and officially accepted on 28 August 1995; third and fourth received in 1996; these four numbered 20 to 23 (prompting pre-series 021 to be renumbered 024 to avoid confusion). Arsenyev production was to have increased to one per month during 1997, but this did not occur. The original Ka-50 (and rival Mi-28A) were overtaken by the issue of a revised requirement which emphasised night capability—favouring the two-seat Mi-28. The initial order for 15 Ka-50s was reportedly cancelled in September 1998, with procurement postponed until 2003. Three deployed to Mozdok during 1999 for use in Chechnya, but not used operationally. Two returned to theatre in December 2000; first firing of weapons against guerrilla forces was on 6 January 2001 (operating in conjunction with Mil Mi-24s); helicopters returned to Torzhok in March 2001. Unspecified modifications, found necessary as a consequence of operational deployment, had been incorporated by November 2002, according to a Kamov announcement.

Klimov VK-3000 turboshaft offered as alternative power plant. By late 2004, it was being presumed that no further production of Ka-50s would take place, the Russian Air Forces having, instead, chosen Mil Mi-28 as main attack helicopter, backed by smaller number of Kamov Ka-52s. One year later, Russian Air Forces C-in-C was anticipating Ka-50 production to restart in 2005, to which end Arsenyev plant began restoring production line, where three Ka-50s partly complete; these still present in January 2006, with delivery due that year; fourth and fifth to follow.

CURRENT VERSIONS: Ka-50: ('Hokum') As described.

Ka-50N: (Nochnoy: Nocturnal) Also reported as Ka-50Sh. Night-capable attack version; essentially a single-seat Ka-52. Programme began 1993; originally based on TpSPO-V and Merkury LLLTV systems, which tested on Ka-50 development aircraft. Ka-50N first reported April 1997 as conversion of prototype 018 with Thomson-CSF Victor FLIR turret above the nose and Arbalet (crossbow) mast-mounted radar, plus second TV screen in cockpit; FLIR integrated with Uralskiy Optiko-Mekhanicheskii Zavod (UOMZ) Shamshit-50 (Laurel-50) electro-optic sighting system, incorporating French IR set. First flight variously reported as 4 March or 5 May 1997; programmed improvements included replacement of PA-4-3 paper moving map with digital equivalent; by August 1997, FLIR turret was repositioned below nose and Arbalet was removed; by mid-1998, had IT-23 CRT display replaced by TV-109, and HUD removed and replaced by Marconi helmet display. Proposed new cockpit shown in September 1998, having two Russkaya Avionika 203 × 152 mm (8 × 6 in) LCDs and central CRT for sensor imagery. Indigenous avionics intended for any local production orders; French systems as interim solution and standard for export. Republic of Korea Army evaluated both the Ka-50N and the baseline Ka-50. In 1999, preproduction aircraft 014 was exhibited with a UOMZ GOES sensor turret in place of Shkval.

Ka-50-2: Designation applies to three quite different aircraft. Basic Ka-50-2 is a variant of the Ka-50 single-seater, though the designation is also applied to two twin-seat aircraft; first of these was a version of the Ka-52 Alligator and, as such, was described in 2001-02 and earlier *Jane's*. All Ka-50-2s differ from the baseline Ka-52 in retaining attack and anti-tank role using 12 laser beam-riding AT-8 Vikhr ATGMs or 16 Rafael NT-D ATGMs; avionics to be supplied by Israel Aircraft Industries, Lahav Division; 024 used as demonstrator. The basic Ka-50-2 was proposed to China, Finland, India, South Korea, Malaysia, Myanmar, Poland, South Africa, Syria and Turkey.

Second variant of Ka-50-2 is another two-seater, intended to have conventional stepped tandem cockpits; is offered to armed forces which do not accept the single-seat or side-by-side two-seat layouts. A further subvariant of the tandem-seat Ka-50-2, the **Erdoğan** (Turkish for Born Fighter), was proposed to Turkey jointly by Kamov and Israel Aircraft Industries. This would have been fitted with longer-span wings and feature a NATO-compatible Giat 621 turret containing a single 20 mm cannon which would fold down below the belly of the helicopter in flight, for a 360° arc of fire; it would fold to starboard for landing, and could be fired directly forward, even when folded. TV3-117VMA-02 engines. Ten Turkish pilots flew Alligator 061 at Antalya, Turkey, in early 1999 as part of evaluation process; requirement was for 145. Named as second choice when Bell AH-1Z selected, and negotiations briefly reopened in mid-2002, following impasse in agreement with USA.

Ka-52: Two-seat version; described separately.

CUSTOMERS: Four for Russian Army service trials, plus eight flying prototype and pre-series helicopters; all delivered. First eight had been built by 1996; next four deliveries began in 2000. Other sources report 15 Ka-50s completed, but this may include static test airframes. By January 2006, some 17 partly complete airframes at Arsenyev plant, of which first three due for completion in that year. One army helicopter lost in accident, 17 June 1998; attributed to rotor clash.

COSTS: Unit price of Ka-50N quoted as between USD12 million and USD15 million in mid-1999.

DESIGN FEATURES: World's first single-seat close support helicopter. Coaxial, contrarotating and widely separated semi-rigid three-blade rotors, with swept blade tip, attached to hub by steel plates; small fuselage cross-section, with nose sensors; flat-screen cockpit, heavily armour protected by combined steel/aluminium armour and spaced aluminium plates, with rearview mirror above windscreen; small sweptback tailfin, with inset rudder and large tab; high-set tailplane on rear fuselage, with endplate auxiliary fins; retractable landing gear; mid-set unswept wings, carrying ECM pods at tips; four underwing weapon pylons; engines above wingroots; high agility for fast, low-flying, close-range attack role; partially dismantled can be air-ferried in Il-76 freighter. Much of fuselage skin formed by large hinged door panels, providing access to interior equipment from ground level.

FLYING CONTROLS: Kamov coaxial design; generally as Ka-32.

STRUCTURE: Fuselage built around steel torsion box beam, of 1.0 m (3 ft 3/4 in) square section.

Wing centre-section passes through beam. Cockpit mounted at front of beam, gearbox above and engines to sides. Carbon-based composites materials constitute 35 per cent by weight of structure, including rotors. Approximately 350 kg (770 lb) of armour protects pilot, engines, fuel system and ammunition bay; canopy and windscreen panels are 55 mm (2 1/4 in) thick bulletproof glass.

LANDING GEAR: Hydraulically retractable tricycle type; twin-wheel steerable nose unit and single mainwheels all semi-exposed when up; all wheels retract rearward; low-pressure tyres.

POWER PLANT: Two 1,633 kW (2,190 shp) Klimov TV3-117VMA turboshafts with VR-80 main reduction gearbox and two PVR-800 intermediate gearboxes, with air intake dust filters and exhaust heat suppressors. Later use of 1,838 kW (2,465 shp) TV3-117VMA-SB3 turboshafts intended. Two primary fuel tanks, filled with reticulated foam, inside fuselage box beam. Total internal capacity approximately 1,800 litres (485 US gallons; 404 Imp gallons). Front tank feeds port engine; rear feeds starboard and APU. Each tank protected by layers of natural rubber. Provision for four 500 litre (132 US gallon; 110 Imp gallon) underwing auxiliary fuel tanks. Transmission remains operable for 30 minutes after oil system failure.

ACCOMMODATION: Double-wall steel armoured cockpit, able to protect pilot from hits by 20 and 23 mm gunfire over ranges as close as 100 m (330 ft). Interior black-painted for use with NVGs. Specially designed Zvezda K-37-800 ejection system, ostensibly for safe ejection at any altitude (actually from 100 m; 330 ft); following explosive separation of rotor blades and opening of cockpit roof, pilot is extracted from cockpit by large rocket; alternatively, he can jettison doors and stores before rolling out of cockpit sideways. Associated equipment includes automatic radio beacon, activated during ejection, inflatable liferaft and NAZ-7M survival kit.

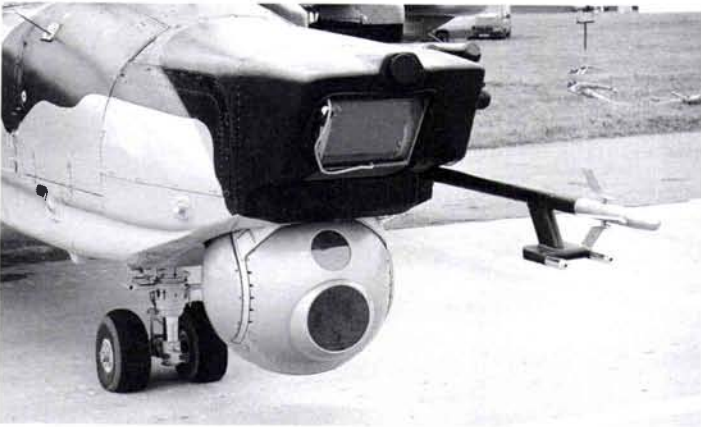
SYSTEMS: All systems configured for operational deployment away from base for up to 12 days without need for maintenance ground equipment; refuelling, avionics and weapon servicing performed from ground level. AI-9V APU for engine starting, and ground supply of hydraulic and electrical power, in top of centre-fuselage. Anti-icing system for engine air intakes, rotors, AoA and yaw sensors; de-icing of windscreen and canopy by liquid spray.

PrPNK Rubikon (L-041) piloting, navigation and sighting system based on five computers; four Orbita BLVM-20-751s for combat and navigation displays and target designation, plus one BCVM-80-30201 for WCS. Incorporates PNK-800 Radian navigation system, with C-061K pitch and heading data, IK-VSP-VI-2 speed and altitude and PA-4-3 automatic position plotting subsystems. Series 3 Tester U3 flight data recorder. Ekran BITE and warning system. KKO-VK-LP oxygen system with 2 litre (0.07 cu ft) supply for 90 minutes. Electrical supply from two 400 kW generators at 115 V 400 Hz three-phase AC; 500 W converter; rectifiers for 27 V DC supply.

AVIONICS: Integrated by NPO Elektro Avtomatika.

Comms: Two R800L1 and one R-868 UHF transceivers, SPU-9 intercom, P-503B headset recorder, Almaz-UP-48 voice warning system and HF com/nav; IFF ('Slap Shot').

Flight: INS; autopilot; Doppler box under tailboom; ARK-22 radio compass; A-036A radio altimeter.



Nose detail of Ka-50Sh (Yefim Gordon)

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Instrumentation: Conventional instruments; ILS-31 HUD; moving map display (Kronshtadt Abris on some aircraft); small IT-23MV CRT beneath HUD, with rubber hood, to display only FLIR and monochrome LLLTV imagery. Pilot has Obzor-800 helmet sight effective within $\pm 60^\circ$ azimuth and from -20 to $+45^\circ$ elevation; when pilot has target centred on HUD, he pushes button to lock sighting and four-channel digital autopilot into one unit. Displays compatible with OVN-1 Skosok NVGs.

Mission: To reduce pilot workload and introduce a degree of low observability, target location and designation are assigned to other aircraft; equipment behind windows in nose includes I-25IV Shkval-V daylight electro-optical search and auto-tracking system, laser marked target seeker and range-finder; FOV $\pm 35^\circ$ in azimuth ± 15 to -80° in elevation. FLIR turret to be added in nose for use with NVGs.

Self-defence: L150 Pastel RWR in tailcone, at rear of each wingtip EW pod and under nose; total of 512 chaff/flare cartridges (in four U'V-26 dispensers) in each wingtip pod, L-140 Otklik laser detection system; L-136 Mak IR warning.

ARMAMENT: Four BD3-UV pylons on wings. Up to 80 S-8 80 mm air-to-surface rockets in four underwing B8V20A packs or 20 S-13 122 mm rockets in four B-13L pods; or up to 12 9A4172 Vikhr-M (AT-12) tube-launched laser-guided ASMs with range of 8 to 10 km (5 to 6.2 miles) capable of penetrating 900 mm of reactive armour; or mix of both; Vikhr launched from trainable UPP-800 mounts, which can be depressed to -12° ; single-barrel 30 mm 2A42 gun on starboard side of fuselage, with up to 470 armour-piercing or high-explosive fragmentation rounds, can be depressed from $+3^\circ 30'$ to -37° in elevation and traversed from $-2^\circ 30'$ to $+9^\circ$ in azimuth hydraulically and is kept on target in azimuth by tracker which turns helicopter on its axis; two ammunition boxes in centre-fuselage. Front box contains 240 AP rounds, rear box 230 HE rounds. Selectable rapid (550 to 600 rds/min) or slow (350 rds/min) fire, with bursts of 10 or 20 rounds. Provision for alternative weapons, including UPK-23-250 23 mm gun pods, Igla or R-73 (AA-11'Archer') AAMs, Kh-25MP (AS-12 'Kegler') ARMs, FAB-500 bombs or dispenser weapons.

DIMENSIONS, EXTERNAL:	
Rotor diameter (each)	14.50 m (47 ft 7 in)
Length overall, rotors turning	16.00 m (52 ft 6 in)
Fuselage length, excl noseprobe	14.20 m (46 ft 7 in)
Wing span	7.34 m (24 ft 1 in)
Height overall	4.93 m (16 ft 2 in)
Tailplane span	3.16 m (10 ft 4½ in)
Wheel track: main	2.67 m (8 ft 9 in)
nose	0.34 m (1 ft 1½ in)
Wheelbase	4.19 m (13 ft 9 in)

AREAS:	
Rotor disc (each)	165.13 m ² (1,777.4 sq ft)

WEIGHTS AND LOADINGS:	
Weight empty	7,800 kg (17,196 lb)
Max external stores	3,000 kg (6,610 lb)
Normal T-O weight: Ka-50	9,800 kg (21,605 lb)
Erdoğan	9,800 kg (21,605 lb)
Max T-O weight: Ka-50	10,800 kg (23,810 lb)
Erdoğan	11,300 kg (24,912 lb)

PERFORMANCE:	
Max speed:	
in shallow dive	210 kt (390 km/h; 242 mph)
in level flight	162 kt (300 km/h; 186 mph)
in sideways flight	43 kt (80 km/h; 49 mph)
in backward flight	48 kt (90 km/h; 55 mph)
Cruising speed	146 kt (270 km/h; 168 mph)
Vertical rate of climb at 2,500 m (8,200 ft)	600 m (1,970 ft)/min
Service ceiling	5,500 m (18,040 ft)
Hovering ceiling OGE	4,000 m (13,120 ft)
Range: combat	243 n miles (450 km; 279 miles)
with max internal fuel	280 n miles (520 km; 323 miles)
with 4 auxiliary tanks:	
Ka-50	594 n miles (1,100 km; 683 miles)
Erdoğan	626 n miles (1,160 km; 720 miles)
Endurance: standard fuel, 10 min reserves	1 h 40 min
with 2 auxiliary tanks	2 h 50 min
g limit	+3.5

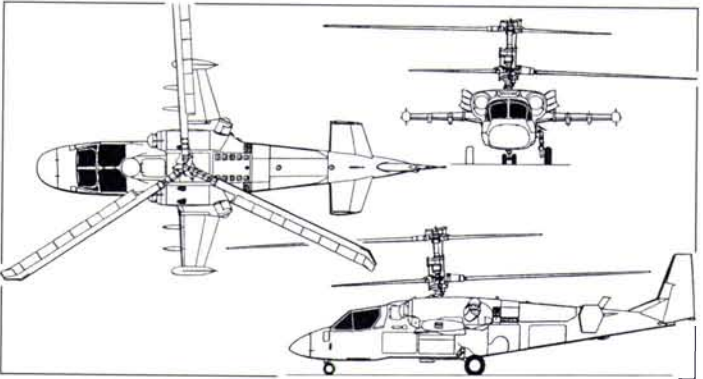
KAMOV Ka-52 ALLIGATOR

PROGRAMME: Only one prototype of this two-seat combat helicopter has been built. Attempts to secure a customer continued in 2001–02 with the offer of a Ka-52K variant to South Korea. Flight performance tests completed late 2002; second stage of State Tests was due to have begun in early 2003, up to which time, it was confirmed, the Arbalet radar had not been installed (except for display purposes). Radar trials were said to have begun by November 2003 but a January 2005 report stated that these shortly to begin, following 17 test flights in first stage of radar trials. Further round of cannon, rocket and missile firing trials at 344th CCTC, Torzhok, completed in early 2006. Irregular financing expected to cause trials to be extended over an indefinite period, but in a surprise announcement of December 2003, C-in-C of Russian Air Forces revealed plans for delivery of 12 Ka-52s (and



Unique Kamov Ka-52 displayed at Moscow in 2005 with mast-mounted radar

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Kamov Ka-52 combat helicopter (Paul Jackson)

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some Mil Mi-28s) to begin in early 2004. One year later, the target had been changed to three delivered in 2005 and two in 2006, all from 'Progress' plant at Arsenyev. None noted by early 2006; however, commitment maintained to small number of Ka-52s to be obtained for "special units". During 2004, Yemen was mentioned as a possible customer for 12 Ka-52s, while Turkish interest maintained into 2006.

KAMOV Ka-60 KASATKA

English name: Killer Whale
TYPE: Medium transport helicopter.
PROGRAMME: Original coaxial rotor, twin tail, single-engined V-60 won Soviet Army lightweight helicopter and Mi-8 replacement competition against heavier, twin-engined Mil Mi-36 in 1982; subsequently, design considerably modified to achieve greater speed through adoption of single main rotor and Fenestron-type of tail rotor with eleven blades. First flight originally due 1993, but programme slowed by funding shortages, and priority changed to promotion of civil variant (see following entry for Ka-62). Ka-60 officially revealed at Lyubertsy on 29 July 1997, when prototype close to completion; first flew (601) 10 December 1998; second sortie 21 December; first official flight 24 December; all were hovering flights; international debut at MAKS '99, Moscow, August 1999; first 'forward flight' 24 December 1999. Further testing was intermittent, due to irregular Ministry of Defence funding; production versions of RD-600V turboshaft installed mid-2002. At this time, it was stated only that the prototype had completed "several" flights, although State Trials were not due to begin until early 2003, which subsequently postponed to 2004. No. 601 had flown some 50 hours by October 2003.

Conflicting reports quote both Arsenyev and Ulan Ude as prospective production lines. However, LMZ (now LAPIK, part of RSK 'MiG') was reported in April 2000 to be preparing for production and in mid-2001 was building second prototype, which to be completed as a trainer in **Ka-60U** configuration. This entered final assembly in July 2002, although RD-600 engines were not due to have been received until late 2002. Displayed, apparently unflown, (marked as 602) at MAKS '03, Moscow, August 2003. Revised configuration, with vertical stabilising fins repositioned from tailboom to top of fin. No. 602 shown at Moscow in 2005 with engines installed, apparently still unflown.

Series production by LAPIK was due to begin in 2003, later delayed to 2005. Meanwhile, third prototype was to have been completed in 2004 in assault transport configuration, all three to participate in almost 400 sorties of State Tests, lasting two years. By early 2004, Kamov was engaged in a redesign of the Ka-60 to address CG and controllability problems caused by overweight tail structure and insufficient torque control. Measures include enlargement of tail rotor and a re-proportioned fin. No further progress reported by early 2006, when prototype remained sole Ka-60 confirmed to have flown. Change to VK-1500 engine in production version requires new main gearbox.

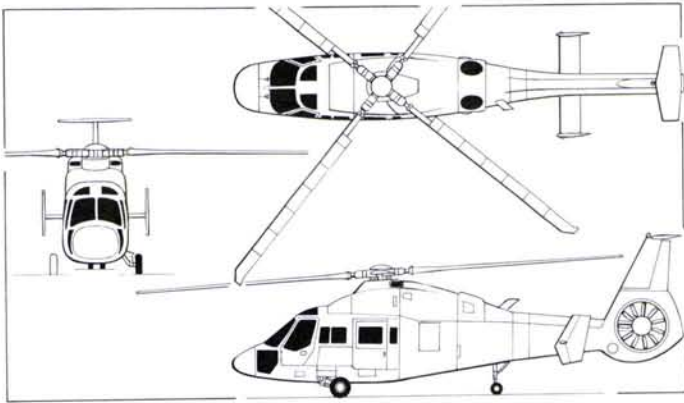
In August 2002, it was announced that power plant will be changed to Klimov VK-1500 to increase participation by RSK 'MiG' group.

A smaller variant of Ka-60 was reported in mid-2001 to have been offered to Russian Navy.



Second Kamov Ka-60 after installation of engines (Yefim Gordon)

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Original configuration of Kamov Ka-60 military multipurpose helicopter (James Goulding) 0062678

CURRENT VERSIONS: Pilot and aircrew training (Ka-60U), utility, shipborne over-the-horizon targeting (Ka-60K) reconnaissance (Ka-60R) anti-tank and anti-helicopter versions proposed; role of Ka-60R, with Shamshit target acquisition system, transferred to Kamov Ka-52.

CUSTOMERS: None. Long-term interest maintained by Russian Army; reportedly evaluated by Iran. Russian requirements estimated as over 100 Ka-60Us between 2001 and 2010.

COSTS: USD1.7 million, Ka-60U (2000).

DESIGN FEATURES: Generally as for Ka-62 (which see), but with IR- and radar-absorbent coatings, reduced rotor speed, low-IR exhausts.

POWER PLANT: Prototype has RKBm Rybinsk RD-600V turboshafts, as Ka-62. Production engine will be 1,103 kW (1,479 shp) Klimov VK-1500, RRTM RTM322 or GE CT7 available in export versions.

ACCOMMODATION: Up to 16 infantry troops; or six stretchers and three attendants. Pilot (starboard) and co-pilot/gunner (port) side by side. Provision for dual controls; control stick top common with Ka-50/52.

SYSTEMS: All Russian; Western equivalents optional for export.

AVIONICS: As above, including Pastel RWR and Otklik laser warning system.

Radar: Arbalet MMW antenna in nose.

Instrumentation: Three-screen EFIS.

EQUIPMENT: Cargo hook.

ARMAMENT: One-piece transverse boom through cabin, to rear of doors, optional to provide suspension for total of two B-8V-7 seven-round 80 mm rocket pods, two 7.62 mm or 12.7 mm gun pods, or similar armament.

DIMENSIONS, EXTERNAL: As Ka-62 except:

Fuselage length 13.465 m (44 ft 2 in)

WEIGHTS AND LOADINGS: Generally as Ka-62 except:

Max payload: external 2,750 kg (6,062 lb)

KAMOV Ka-62

TYPE: Multirole medium helicopter.

PROGRAMME: This civil version of Kamov Ka-60 appears to have made little progress in recent years. No prototype had been built by 2006, priority of Ka-62 indicated by official announcement in October 2006 that building of a prototype (which would be fourth Ka-60/62) only could "not be ruled out".

Funded under Russian programme for development of civil aviation for 2000. Construction of prototype Ka-62 (then known as V-62) began early 1990, but apparently abandoned: one Ka-60 military version (which see) and two Ka-62s intended to undertake flight trials, although second of basic type completed as Ka-60U, delaying debut of civil version; will be certified under Russian AP and FAR Pt 29A/B standards. Republic of Buryatia officially requested Moscow for production rights for UAP in February 2000. In April 2001, Turkish Ministry of Public Health was discussing contract for six Ka-62s, with total value of US\$31.5 million.

Russian government's 2002-10 aviation plan includes Rb62 million to develop Ka-62 and Rb51 million to launch production at UUAP and, possibly, RSK 'MiG' (LAPIK). UUAP confirmed Ka-62 production plans in January 2006, at which time USD60 million had been invested out of USD150 million required to launch manufacture; initial production helicopter due to fly in 2008-09 and annual rate of 30 to 40 per year to be achieved by 2010.

Initial deployment will be in Khabarovsk Federal District of Russian Far East, following June 2002 agreement between Kamov and Far East Investment Company for manufacture of Ka-62 at unspecified plant(s) and marketing in Asia/Pacific region.

CURRENT VERSIONS: **Ka-62:** Basic model for domestic market.

Detailed description applies to the above.

Ka-62M: To be certified to Western standards, for sale outside Russian Federation and Associated States (CIS); two 1,212 kW (1,625 shp) General Electric T700/CT7-2D1 turboshafts; five-blade main rotor; avionics to be developed by Aviapribor. Production version is expected to be manufactured by KnaAPO at Komsomolsk.

Ka-64 Sky Horse: The development of the Ka-60/62 series is reported to be a joint venture with Agusta of Italy intended for export. Features include a conventional tail rotor, modified passenger cabin, Western avionics and option of General Electric CT7-2DL, LHTEC T800 or RRTI RTM 322 turboshaft engines. Production would be by UAP at Ulan-Ude.

DESIGN FEATURES: Originated as military transport; all main systems and components duplicated, with main and secondaries routed on opposite sides of airframe; transmission resistant to 12.7 mm bullets; main blades to 23 mm shells; run-dry gearboxes. Advanced technology main rotors with sweptback tips. Production versions will have slower-turning five-blade rotor. Yaw control by 11-blade fan-in-fin. Reverse tricycle landing gear.

STRUCTURE: Composites account for 60 per cent, by weight, of structure, including blades of main rotor; fuselage sides, doors, floor and roof, tailboom, fin, vertical stabilisers, and fan blades of carbon-reinforced Kevlar.

LANDING GEAR: Retractable reverse tricycle type; single KT-217 mainwheels retract inward and upward into bottom of fuselage; twin rear wheels retract forward into tailboom; shock-absorber in each unit. Optional inflatable pontoons for emergency use on water.

POWER PLANT: Basic Ka-62 has two RKBm Rybinsk RD-600V turboshafts, each 956 kW (1,282 shp) max continuous; 1,140 kW (1,529 shp) emergency rating. However 1,103 kW (1,479 shp) Klimov VK-1500 may be offered in parallel with adoption of this engine for



Model of Kamov Ka-62 civil multirole helicopter, confusingly wearing military camouflage (Yefim Gordon) 0528671

Ka-60, Fuel tanks under floor, capacity 1,450 litres (383 US gallons; 319 Imp gallons). General Electric T700/CT7-2D1 offered as alternative to RD-600V.

ACCOMMODATION: Crew of one or two, side by side; optional bulkhead divider between flight deck and cabin; up to 14 passengers in four rows; forward-hinged door each side of flight deck; large forward-sliding door and small rearward-hinged door each side of cabin; baggage hold to rear of cabin. VIP configuration to be available, with five to nine seats and refreshment bar.

SYSTEMS: Interior heated and air conditioned. Thermoelectric de-icing system optional. Ivchenko AI-9V APU originally proposed, but replacement Aerosila TA-14 under development.

AVIONICS: Optional Russian or Western.

EQUIPMENT: Stretchers, hoist above port cabin door, cargo tiedowns, and other items as necessary for variety of roles, including transport of slung freight; air ambulance/operating theatre; search and rescue; patrol of highways, forests, electric power lines, gas and oil pipelines; survey of ice areas; surveillance of territorial waters, economic areas and fisheries; mineral prospecting; and servicing of offshore gas and oil rigs.

DIMENSIONS, EXTERNAL:

Main rotor diameter 13.50 m (44 ft 3 1/2 in)

Tail rotor diameter 1.40 m (4 ft 7 in)

Length overall, rotors turning 15.60 m (51 ft 2 1/4 in)

Fuselage length 13.465 m (44 ft 2 in)

Height: overall 4.60 m (15 ft 1 in)

to top of rotor head 3.80 m (12 ft 5 1/2 in)

Width over endplate fins 3.00 m (9 ft 10 in)

Wheel track 2.50 m (8 ft 2 1/2 in)

Wheelbase 5.445 m (17 ft 10 1/4 in)

Cabin doors (each) Height 1.30 m (4 ft 3 1/4 in)

Width 1.25 m (4 ft 1 1/4 in)

DIMENSIONS, INTERNAL:

Cabin, excl flight deck: Length 3.40 m (11 ft 2 in)

Width 1.78 m (5 ft 10 in)

Height 1.30 m (4 ft 3 1/4 in)

AREAS:

Main rotor disc 143.10 m² (1,540.3 sq ft)

Tail rotor disc 1.54 m² (16.57 sq ft)

WEIGHTS AND LOADINGS:

Max payload: internal: 62, 62M 2,000 kg (4,409 lb)

external: 62, 62M 2,500 kg (5,510 lb)

T-O weight: 62, normal 6,000 kg (13,228 lb)

62, internal load, max 6,250 kg (13,779 lb)

62 external load and 62M, internal load, max 6,500 kg (14,330 lb)

62M, external load, max 6,750 kg (14,880 lb)

Max disc loading: 62 41.9 kg/m² (8.58 lb/sq ft)

62M 47.1 kg/m² (9.66 lb/sq ft)

PERFORMANCE (estimated, at max T-O weight with internal load):

Max level speed:

62, 62M 162 kt (300 km/h; 186 mph)

Cruising speed: 62, 62M 148 kt (275 km/h; 171 mph)

Max rate of climb at S/L: 62 625 m (2,050 ft)/min

62M 690 m (2,263 ft)/min

Rate of climb at S/L, OEI: 62, 62M 123 m (403 ft)/min

Service ceiling: 62 5,150 m (16,900 ft)

62M 5,500 m (18,040 ft)

Hovering ceiling: IGE: 62 2,900 m (9,520 ft)

OGIE: 62 2,100 m (6,880 ft)

62M 2,500 m (8,200 ft)

Range with max standard fuel at 2,000 m (6,560 ft), no reserves: 62

332 n miles (615 km; 382 miles)

62M 353 n miles (655 km; 407 miles)

Range with auxiliary fuel at 2,000 m (6,560 ft), no reserves: 62

566 n miles (1,050 km; 652 miles)

62M 553 n miles (1,025 km; 637 miles)

KAMOV Ka-226A SERGEI

TYPE: Light utility helicopter.

PROGRAMME: Turbine version of Ka-26, of which 816 built between 1968 and 1977. Announced at 1990 Helicopter Association International convention, Dallas, USA. Developed originally for Russian TsENTROSPAS disaster relief ministry, which is providing significant funding. First flight (KA-00199), at Lyubertsy, 3 September 1997; 'official' first flight on following day. Flew total of four sorties by 31 December 1997. Began AP-29 certification testing on 28 March 2001. State ground testing of Ka-226 second prototype completed at Strela's Orenburg plant on 6 March 2000. KAPP built two prototypes, of which first was rolled out at Kumertau on 29 May 1998; first production aircraft from KAPP was due to have flown in first quarter of 2002 but remained under construction in mid-2002, although a 'pre-production' helicopter was shown (red colour scheme) in April 2002. Planned certification in third quarter of 2002 was not achieved.



Prototype Kamov Ka-226T utility/lift version (Yefim Gordon)
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being reportedly "seriously delayed". Provisional certification awarded by Interstate Aviation Committee (IAK) on 18 August 2003. First deliveries to Gazprom in June 2004, at which time IFR certification had not been achieved, although full VFR granted 19 August 2004. Prototype destroyed in ground resonance incident, November 2002, but apparently replaced by demonstrator '199', displayed at Moscow, August 2003.

Named Sergei in 1999, honouring politician Sergei Shoigu, but programme also guided by Sukhoi General Designer, Sergei Mikheev. By mid-2000, Moscow regional government had provided Rb12 million in development funding and was beginning disbursements under second programme valued at Rb4 million. Initial deliveries due in first half of 2000, but not effected.

Prototypes built jointly by Kamov, Strela, KAPP and Ufa Motors, with final assembly by KAPP and Strela for production aircraft. Strela scheduled to have delivered five preproduction helicopters to Kamov at Lyubertsy by mid-2000; these for MChS Rossii, but not completed until 2003, when one exhibited at MAK '03, prior to suspension of the order. Ka-32 obtained in interim, but reinstated order for three Ka-226As under negotiation in 2004. KAPP designated second production plant: first batch of five under construction by 2001. Motor-Sich of Zaporozhye, Ukraine, negotiated with Kamov in June 2000 to build Ka-226s powered by indigenous ZMKB AI-450 engine; agreement on AI-450 installation signed 15 August 2001. On 19 October 2001, however, Motor Sich announced it would source all Ka-226 components with Ukrainian industry, if decision to proceed were taken. In March 2006, Russo-Jordanian joint venture company, Oboronprom Middle East, formed to assemble Ka-226s in Jordan.

Batch of Rolls-Royce 250 engines ordered by Kamov in July 2000. Later contracts in December 2004 (24 engines) and August 2005 (50 engines for delivery by November 2006).

CURRENT VERSIONS: **Ka-226A:** As described.

Ka-226AG: Gazprom specific configuration, including cargo winch and medical equipment.

Ka-226-50: Designation first revealed in September as 'improved' version, but appears to apply to all production aircraft (at least from KAPP).

Ka-226T: Two Turbomeca Arrius 2G2 turboshafts, each 500 kW (670 shp); service ceiling increased to 7,000 m (22,960 ft).

MoU on use of Turbomeca Arrius 2G2 signed in August 2001 with NPO Saturn and French manufacturer; collaboration agreement followed on 16 April 2002, and engines delivered in December 2003. First stage of Arrius testing completed April 2005. Prototype (221) first flew December 2004; camouflage paint applied January 2005; public debut at Moscow Salon, August 2005.

Ka-226U: Dual control trainer. First order placed early 2003 for one helicopter to fly in 2004, following manufacture at Kamov's own plant, Progress AI-450 turboshafts.

CUSTOMERS: Orders by January 2002 totalled 66: Gazprom 50 (of which 22 firm), Moscow City 10, TsENTROSPAS five and Bashkiriyan one. This had increased to 80 by August 2003.

Firm order for 25 reportedly received from TsENTROSPAS by 1997, but quantity had reduced to 10 by 1999; by mid-2000 this quoted as five firm (to be first five production aircraft) and further 15 to be ordered by 2002; manufacture by Strela which had completed first two (including one in medevac configuration) by early 2002, but in October 2003 it was reported that all five had been "frozen". Bashkiriyan local government ordered one Ka-226-50 from KAPP in September 2001; this accepted 28 December 2001 (when still not cleared for flight) and due for trials at Zhukovsky before service entry. Funds for 22 of initial Gazprom order for 50 had been transferred by 2001, this initial batch, built by Strela, to have been received by 2005 (although formal signing of order for 50 was undertaken at Moscow Salon in August 2001). First for Gazprom handed over at Ostafyevo, Moscow Region, on 10 June 2004 in baseline configuration: 18 of remainder modified to specific customer requirements, designated Ka-226AG, and all 22 due in service by 2007.

Moscow city government signed USD1.5 million order for 10 in December 2001, delivery over two years, but later announcement indicated that funds had not been earmarked; Moscow's helicopters built by KAPP. City allocated initial Rb33 million in



Kamov Ka-226 demonstrator '201' exhibited in Jordan, March 2006, to promote local assembly plans
 1158059



Kamov Ka-226 from Strela production line (Yefim Gordon)
 1128962

2002 and intended to receive three helicopters in 2003, four in 2004 and final three in 2005. Subsequently amended to first two receipts in 2004, although their arrival not confirmed. These may now have been received, in light of December 2005 delivery to "Security Services" of "a further two" Ka-226s, with another six or eight to be ordered in 2006. Ka-226 was beaten by Kazan Ansat in competition to supply new training helicopter to Russian armed forces, announced September 2001; however, small number of Ka-226s required by Russian Navy.

COSTS: USD1.5 million (2003). Batch of five for MChS worth RUR187 million (2003). Development cost RUR108 million (1999).

DESIGN FEATURES: Classic Kamov utility helicopter, featuring interchangeable mission pods. Refined development of Ka-26/126; new rotor system with hingeless hubs and glass fibre/carbon fibre blades; changes to shape of nose, twin tailfins and rudders, and passenger pod; passenger cabin has much larger windows and remains interchangeable with variety of payload modules including agricultural systems with hopper capacity of 1,000 litres (264 US gallons; 220 Imp gallons); Kamov BP-226 transmission; new rotor system, interchangeable with standard coaxial system, will become available later.

FLYING CONTROLS: Assisted by irreversible hydraulic actuators. Automatic rotor constant-speed control; conventional four-channel control (longitudinal, lateral, cyclic and differential pitch). Two endplate fins and rudders, toed inward 15°; fixed horizontal stabiliser.

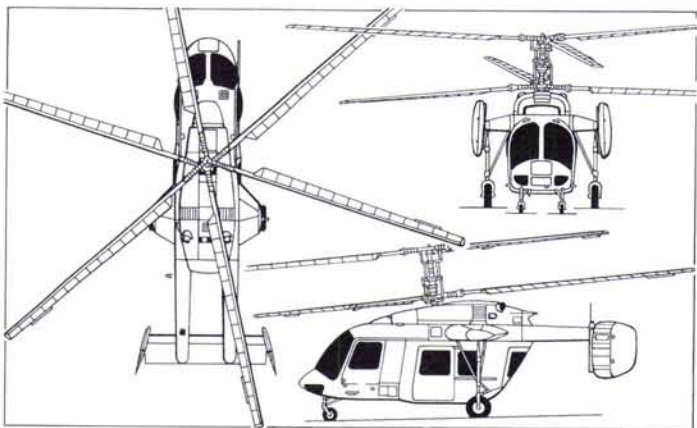
STRUCTURE: Primarily of aluminium alloys, steel alloys and composites sandwich panels of GFRP with honeycomb filler. Rotor blade overhaul interval 2,000 hours; total life 6,000 hours, but to be extended by increments to 18,000 hours.

LANDING GEAR: Non-retractable four-wheel type. Main units at rear, carried by stub-wings. All units embody oleo-pneumatic shock-absorber. Mainwheel tyres size 595x185, pressure 2.50 bar + 0.50 (36.25 lb/sq in + 7.25); forward tyres size 300x125, pressure 3.50 bar + 0.50 (50.75 lb/sq in + 7.25). Forward units of castoring type, without brakes. Rear wheels have pneumatic brakes. Optional skis.

POWER PLANT: Two 335 kW (450 shp) Rolls-Royce 250-C20R/2 turboshafts, side by side aft of rotor mast, with individual driveshafts to rotor gearbox. Two 335 kW (450 shp) Rolls-Royce 250-C20B engines in prototypes. Transmission rating 626 kW (840 shp). Alternatively, two Progress (ZMKB) AI-450 turboshafts, each 331 kW (444 shp) or two Turbomeca Arrius 2G2 (500 kW; 670 shp) or Klimov VK-800 turboshafts (588 kW; 789 shp).

Standard fuel capacity 770 litres (203 US gallons; 169 Imp gallons), in tanks above and forward of payload module area. Provision for two external tanks, on sides of fuselage, total capacity 320 litres (84.5 US gallons; 70.4 Imp gallons).

ACCOMMODATION: Fully enclosed and lightly pressurised flight deck, with rearward-sliding door each side; normal operation by single pilot; second seat and dual controls optional. Cabin ventilated, and warmed and demisted by air from combustion heater, which also heats passenger cabin when fitted. Space aft of cabin, between main landing gear legs and under transmission, can accommodate variety of interchangeable payloads. Standard cargo/passenger pod has two bench seats, each accommodating three persons; one bench faces forward, the other, rear; baggage compartment behind rear wall. Seventh passenger beside pilot on flight deck. 'Service' eight-seat and 'VIP' five-seat pods also available. Two versions of medical pod comprise 'Ambulance' with oxygen, respirator, defibrillator and resuscitation kit; and 'Medevac' with two stretcher patients, two seated casualties and medical attendant plus Cardex MAR-01 monitor, DKI-N-04 defibrillator, EK10-0412 electrocardiograph, EKSM-041 cardio-stimulator, Nonin 8500 pulse-meter, oxygen apparatus and Thermos flask. 'Emergency' pod has two stretchers and simplified medical kit, plus hydraulic rescue tools. 'Law Enforcement' pod includes four abseiling ropes, eight seats and provision on and in main airframe for cockpit side blister windows, SGS-23 loudspeaker, GOES-630 gyro-stabilised turret with thermal imaging camera and TSL-224H video recorder. For agricultural work, chemical hopper (capacity 1,000 litres; 264 US gallons; 220 Imp gallons) and dust spreader or spraybar are fitted in this position, on



Kamov Ka-226A utility helicopter with production passenger cabin design (Mike Keep)
 1158064

aircraft's CG. (Flight deck pressurisation protects crew against chemical ingress.) Aircraft can also be operated with either an open platform for hauling freight or hook for slinging loads at end of a cable or in a cargo net.

SYSTEMS: Single hydraulic system, with manual override, for control actuators. Main electrical system 27 V 3 kW DC, with back-up 40 Ah battery; secondary system 36/115 V AC with two static inverters; 115/200 V AC system with 16 kVA generator (6 kVA to power agricultural equipment and rotor anti-icing). Electrothermal rotor blade de-icing; hot air engine air intake anti-icing; alcohol windscreen anti-icing; electrically heated pitot. Pneumatic system for mainwheel brakes, tyre inflation, agricultural equipment control, pressure 39 to 49 bar (570 to 710 lb/sq in). Oxygen system optional.

AVIONICS: Cockpit instrumentation and avionics to customer's choice, including Bendix/King equipment for IFR flight.

Comms: Twin Yurok radios; SPGU-35 intercom. Optional 4205-02 or UVD SO-94R transponder and ARB PK-10 ELT.

Flight: SVS-226 air data computer, A-053 radar altimeters, ADF-25 ADF, MKS-1V compass. Optional SAU-226 flight control system and VIM-95 navigation and landing sensor for IFR operation. Optional SNS -3 satellite navigation, BUR-LKV flight data recorder.

Instrumentation: SEI-226 display systems, INP-R HSI.

EQUIPMENT: Optional SLG-300 hoist, SX-5 or SX-16 Nitesun spotlight, SGS-23 loudspeaker.

GOES-630 surveillance system, TSK-3 10-person rescue cage.

ARMAMENT: Optional provision for light weapons.

DIMENSIONS, EXTERNAL:

Rotor diameter (each)	13.00 m (42 ft 7 3/4 in)
Length of fuselage	8.10 m (26 ft 7 in)
Width over stub-wings	3.22 m (10 ft 6 3/4 in)
Height to top of rotor head	4.15 m (13 ft 7 1/2 in)
Wheel track: nosewheels	0.90 m (2 ft 11 1/2 in)
mainwheels	2.56 m (8 ft 4 3/4 in)
Wheelbase	3.48 m (11 ft 5 in)
Passenger pod: Length	2.35 m (7 ft 8 1/2 in)

Width	1.40 m (4 ft 7 in)
Height	1.54 m (5 ft 0 3/4 in)
DIMENSIONS, INTERNAL:	
Passenger pod: Length	2.04 m (6 ft 8 1/4 in)
Width	1.28 m (4 ft 2 1/4 in)
Height	1.40 m (4 ft 7 in)

AREAS:

Rotor disc (each)	132.70 m ² (1,428.4 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	1,952 kg (4,304 lb)
Max underslung payload	1,300 kg (2,865 lb)
Max internal fuel	600 kg (1,322 lb)
Auxiliary fuel	256 kg (564 lb)
T-O weight: normal	3,100 kg (6,835 lb)
max	3,400 kg (7,495 lb)
Transmission loading at max T-O weight and power: normal	4.95 kg/kW (8.14 lb/shp)
max	5.43 kg/kW (8.92 lb/shp)

PERFORMANCE (estimated):

Never-exceed speed (VNE)	115 kt (214 km/h; 133 mph)
Max level speed	111 kt (205 km/h; 127 mph)
Max cruising speed	105 kt (194 km/h; 120 mph)
Max rate of climb at S/L	610 m (2,000 ft)/min
Rate of climb, OEI	96 m (315 ft)/min
Vertical rate of climb at S/L	168 m (550 ft)/min
Service ceiling	6,200 m (20,340 ft)
Hovering ceiling OGE	2,500 m (8,200 ft)
Range: with max payload	16 n miles (30 km; 18 miles)
with max internal fuel	324 n miles (600 km; 372 miles)
with auxiliary fuel, no reserves	480 n miles (890 km; 552 miles)
Max endurance with internal fuel, no reserves	4 h 42 min

KAPO

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KAPO (formerly GAZ 22) established in Moscow on 14 May 1927 and moved to Kazan in November 1941; has built more than 18,000 aircraft of 34 types, including the Tu-4, Tu-16, Tu-22, Tu-104 and Il-62. It currently produces the Tupolev Tu-214 and will manufacture the

Tu-334 regional airliner; Tu-330 freighter, if it is ordered; and is assigned the Tu-324 regional airliner. In 2000, KAPO belatedly delivered one Tu-160 strategic bomber, completion of which had been delayed by collapse of the former USSR; a second was to follow in 2002, but has been delayed and a further two are planned. In April 2002, Kazan received the first of 15 in-service Tu-160s to undergo upgrading; two Tu-22Ms also in stock.

Tu-334 production in parallel with Aviant of Ukraine (which will build 20) to begin in 2007 with completion of 12 aircraft, followed by 20 per year until initial batch of 100 (agreed 2004) is delivered. Announcement on 22 February 2005 by Tatarstan president promised first Tu-334 in 2006, changed five months later to 2007, under April 2005 decree by Russian prime minister allocating manufacture. MoU funding production of Tu-334 at Kazan signed 8 March 2006, although devoted to preliminary activities of formulating business plan and gathering "pool of investors".

Under aerospace industry restructuring plans announced in 2001, KAPO is to be joined with RSK 'MiG', Kamov, Tupolev and their associated plants (Sokol, Aviakor, AviaStar and KAPP). The plant also produces customer goods, including leather processing machinery and small boats. Nothing further has been heard of 2002 discussions on the possibility of aerostructures subcontracting for Airbus.

KAZAN

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ANSAT PROGRAMME DIRECTOR: Valery B Kartashev

GAZ 387 founded in Leningrad in 1940 and re-established at Kazan on 15 August 1941 following evacuation. Built 11,344 Polikarpov Po-2 biplanes up to 1947, when production turned to combined harvesters. Since 1951, however, Kazan (KVZ) has marketed and built Mil helicopters comprising 30 Mi-1s, 3,257 Mi-4s, 4,066 Mi-8s, 2,620 Mi-8M/Mi-17s, 273 Mi-14s and (up to 2001) 1,150 Mi-8MTV/Mi-17-1Vs. Exports began in 1956 and now encompass over 80 countries and some 4,000 aircraft; the Mi-17 accounts for 1,200 exports to 30 countries.

Kazan became a joint stock company in 1994, then owned 38 per cent by Tatarstan Republic, 62 per cent by its employees. State holding reduced to 29.92 per cent, but this then transferred to OPK Oboronprom holding company in return for 15.07 per cent stake in latter. Other Oboronprom holders are Rostvertol (2.79 per cent), Rosiboronexport (31.13 per cent) and Tatarstan Republic (51 per cent).

At the 1995 Paris Air Show, Kazan exhibited a mockup of the first product of its own newly formed (1993) design office, the Ansat light multipurpose helicopter. Modifications and upgrades to Mi-17 have generated new business for Kazan. Russian certification for helicopter design awarded February 1997. A second light helicopter, the Aktai, was revealed at Moscow in August 1997 and was due to fly in 2004. In February 2003, Kazan offered to establish a production line for the Mi-52 if Mil is unable to secure funding. Kazan was also a co-founder of Euromil, with Mil Moscow Helicopter Plant, Eurocopter and Klimov, and is responsible for manufacturing parts for, and assembling, the Mi-38 prototypes the first of which flew in December 2003. However, in July 2003, Eurocopter withdrew from Euromil because of Russian laws constricting foreign businesses, allowing Kazan to acquire half its shareholding. Re-integration of Eurocopter would be likely if mooted law change can be effected.

KAZAN/Mil Mi-17

TYPE: Medium transport helicopter.

Following entry refers specifically to Kazan production; refer to Mil entry for other Mi-8M/Mi-17 versions.

PROGRAMME: Kazan's Mi-17 development intended to compete with latest Western helicopters (such as Sikorsky S-92, NH 90 EHI EH 101 and Eurocopter AS 332) combining advanced avionics and systems with well-proven airframe and dynamic system. Prototype (RA-70937, converted from Mi-8MTV) displayed at 1995 Paris Air Show with features including widened forward, port, door; additional starboard door; and rear loading via short ramp and two clamshell doors. Further modified, with large, single-piece rear-loading ramp and other changes, for display at ILA '96, Germany, in search and rescue form, designated Mi-17MD Night. By 1997, '70937 had gained a spine-mounted IR jammer and flight deck armour and was stated by Kazan to have the dual designation Mi-17MD/Mi-8MTV-5. At the 1999 Moscow Air Show it had lost its registration and become an 'Mi-8MTV5-1' with the alternative designations (for export) Mi-17V-5. First flight in this guise was in January 1998; first production Mi-17V-5 flew August 1999.

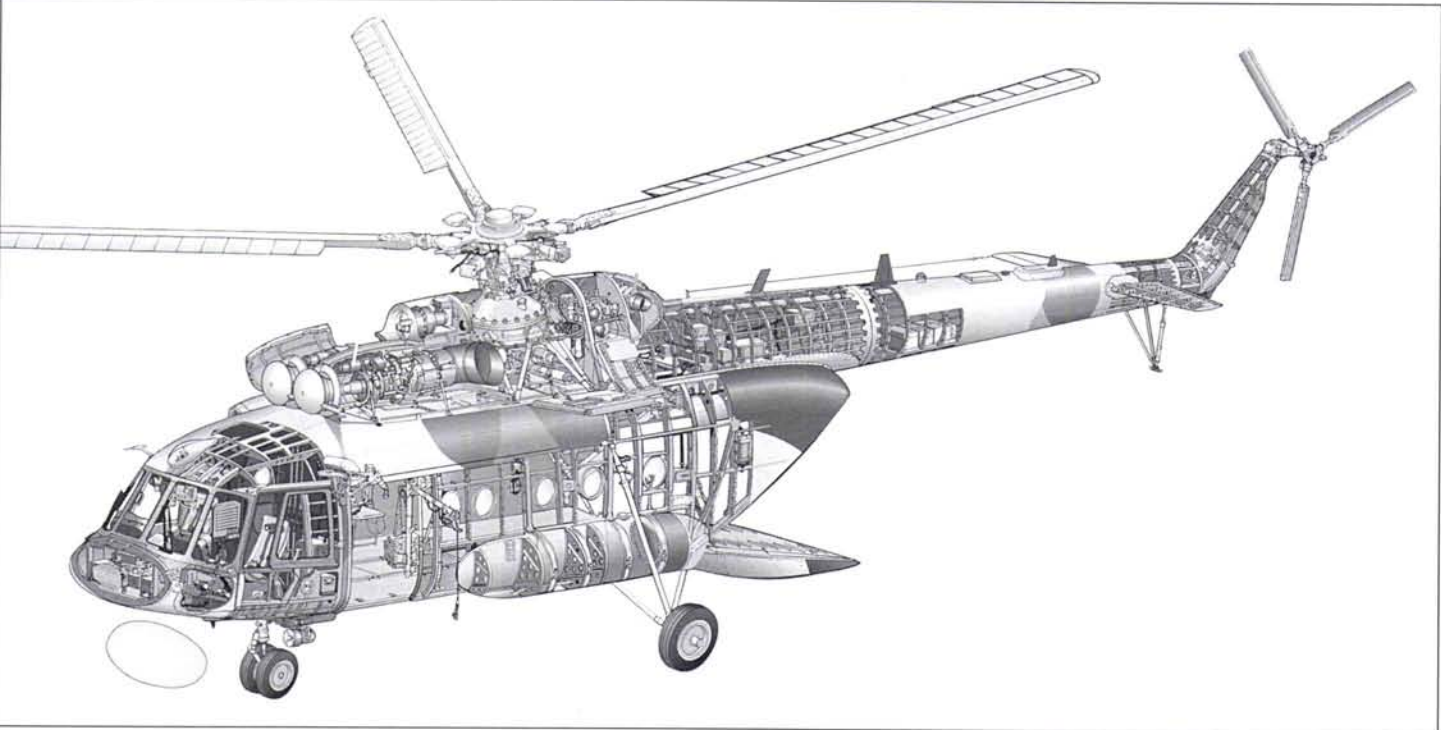
Second example (RA-70877) shown at LIMA, Malaysia, November 1999, marked as Mi-17-1V, although with full Mi-17MD airframe modifications, was conversion of prototype Mi-17KF (Honeywell 'glass cockpit' avionics), destined for South Korean police force (eventually handed over, January 2000). Mi-17KF redesignated Mi-172.

Kazan demonstrator RA-70898, rebuilt in Mi-172 guise in 2000 (following accident) with partial 'glass cockpit' supplied by Elbit. GOES FLIR chin turret and additional external fuel tank (900 litres; 238 US gallons; 198 Imp gallons) each side, increasing range to 600 n miles (1,111 km; 690 miles); optimised for offshore oil support and maritime patrol; displayed at Farnborough, July 2000.

In 2002, Kazan began production of Mi-17V-5 with Klimov VK-2500 engines (replacing 1,471 kW; 1,973 shp TV3-117VMs) for increased high-altitude performance, including increase of 620 m (2,040 ft) in OGE hover and 200 m (660 ft) in service ceiling; can also take off with one engine inoperative; features Saphir APU to permit engine starting at 6,000 m (19,680 ft). Optional equipment includes NVGs, FLIR and searchlight, plus firefighting, SAR and medevac interiors. VK-2500 version certified, and deliveries began, mid-2003.

CURRENT VERSIONS: **Mi-17V-5 (Mi-8MTV5-1):** Rear ramp and either round or square cabin windows. As described.

Mi-17V-7: Upgraded version with VK-2500 engines; uprated transmission; Saphir APU; new, swept-tip, composites main blades, with elastomeric bearings; X-type tail rotor; 'glass



Kazan/Mil Mi-17V-5

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cockpit' by Honeywell; increased service ceiling; and extra 500 kg (1,102 lb) payload. Available from 2005.

Mi-17-1V: Multirole version suitable for duties including flying hospital. Clamshell rear doors and round windows.

Mi-17Z: Passenger version for up to 26 in regular seating or up to 11 VIPs. Clamshell rear doors and square windows. Roles include offshore oil/gas rig support, optionally with weather radar and two additional, external 915 litre (242 US gallon; 201 Imp gallon) fuel tanks.

CUSTOMERS Refer to table:

KAZAN MI-17 DELIVERIES				
Customer	Version	Qty	Year	Remarks
China	Mi-17V-5	60+		Army
Colombia	Mi-17-1V	16	2002	
Cyprus	Mi-172	2		Forestry
India	Mi-17-1V	40	2000	
Iran	Mi-17	3	2004	Health Ministry
Korea, South	Mi-172	2	1999	
Myanmar	Mi-17V-5	7	2004	
Nepal	Mi-17	9	2004	
Rwanda	Mi-17-1V	4	1999	Armed
	Mi-172	1	1999	VIP
Sri Lanka	Mi-17	3		
Venezuela	Mi-17V-5	6	2005	
Vietnam	Mi-17	4	2003	

COSTS: Colombian order for six valued at USD36.1 million (2002).

DESIGN FEATURES: Generally similar to latest versions of Mi-17. Main differences include rear loading ramp and pointed 'Dolphin' nose with increased volume to allow space for radar. Ramp allows disembarkation of 36 equipped troops in less than 15 seconds; helicopter can fly with ramp open for supply dropping. Conventional pod and boom configuration: five-blade main rotor, inclined forward 4° 30' from vertical; interchangeable blades of basic NACA 230 section, twist 5°, thickness/chord ratio 13 per cent at root, 11.38 per cent at tip; spar failure warning system; drag and flapping hinges a few inches apart; flapping compensator and centrifugal blade droop stop; rotor brake standard; non-folding blades carried on machined spider; pendulum vibration damper; three-blade port tail rotor. Transmission comprises VR-14 two-stage planetary main reduction gearbox (engine input 15,000 rpm; oil capacity 49 litres; 12.9 US gallons; 10.8 Imp gallons), intermediate (8A-1515-000) and tail rotor (2Y6-1517-000) gearboxes, and drives off main gearbox for tail rotor, fan, AC generator, hydraulic pumps, compressor and tachometer generators; correct rotor speed maintained automatically by system that also synchronises output of the two engines; tail rotor pylon forms small vertical stabiliser; horizontal stabiliser near end of tailboom.

FLYING CONTROLS: Mechanical system, with irreversible hydraulic boosters; main rotor collective pitch control linked to throttles.

STRUCTURE: All-metal; semi-monocoque fuselage of riveted construction. Main rotor blades of aluminium alloy, each with extruded spar carrying root fitting, 21 honeycomb-filled trailing-edge pockets and blade tip, with titanium abrasion shielding on some of leading-edge; balance tab on each blade; each tail rotor blade made of spar and honeycomb-filled trailing-edge. Composites blades and elastomeric hub components under development.

LANDING GEAR: Non-retractable tricycle type; self-centring twin-wheel nose unit, locked in flight; single wheel on each main unit; oleo-pneumatic (gas) shock-absorbers. Mainwheel tyres 865x280 type K2-110, pressure 5.4 bar (78 lb/sq in); nosewheel tyres 595x185 type KT-97/3, pressure 4.4 bar (64 lb/sq in). Pneumatic shoe-type brakes on mainwheels. Optional mainwheel fairings or skis. Optional Aerazur four-bag inflatable emergency floats.

POWER PLANT: Two Klimov VK-2500 turboshafts; installed ratings of 1,986 kW (2,663 shp) in emergency; 1,765 kW (2,367 shp) for T-O. Engine cowling side panels form maintenance platforms when open, with access via hatch on flight deck.

Standard fuel capacity of 2,725 litres (720 US gallons, 599 Imp gallons) in two main external tanks and internal feed tank. Up to four ferry tanks in cabin, each 895 litres (236 US gallons; 197 Imp gallons). Other versions may carry two supplementary tanks externally. Engine oil capacity 15 litres (4.0 US gallons; 3.3 Imp gallons).

ACCOMMODATION: Two pilots side by side on flight deck, with provision for flight engineer's station. Windscreen de-icing standard. Up to 36 troops or 12 casualties on stretchers in cabin. Hydraulically actuated rear ramp.

Two sliding, jettisonable passenger doors at front of cabin, port door widened in comparison with original Mi-17; electrically operated rescue hoist can be installed at this doorway.

SYSTEMS: AP-34B autopilot. ZMKB Progress AI-9 APU at rear of rotor head fairing. AC electrical supply from two 40 kW three-phase 115/220 V 400 Hz GT40P488 generators; two 25 V 20 Ah batteries. Optional KO-50 kerosene heater or air conditioning unit ahead of external fuel tank or over starboard passenger door. Main and auxiliary hydraulic systems, operating pressure between 44 and 64 bar (640 to 924 lb/sq in). Pneumatic system for braking; pressure 4 to 5 bar (58 to 73 lb/sq in); reservoir volume 10 litres (2.6 US gallons; 2.2 Imp gallons). Engine air intake de-icing standard. KKO oxygen system.

AVIONICS: Comms: Yadro-1A1 and KHF 950 VHF; P-863 VHF/UHF; ACR-500 VHF/UHF; Orlan-85ST UHF; UVD CO-70 or CO-96 transponder.

Radar: Type 8A-813, RDR 1400 or RDR 2000 weather radar optional.

Flight: Radio altimeter; radio compass; VOR/ILS; VIM-95; CD-75 VND-94 or Bendix/King KN 62 DME.

Instrumentation: Optionally compatible with night vision goggles.

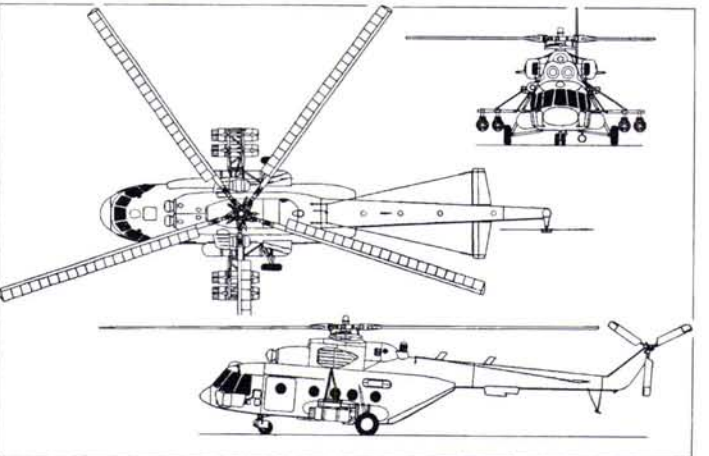
Self-defence : (optional) ASO-2V chaff/flare dispensers under tailboom and L166V1AE IR jammer (NATO 'Hot Brick') at forward end of tailboom.

EQUIPMENT: Optional external hook for underslung loads of up to 4.5 tonnes and 65 m (215 ft) in length at speeds up to 81 kt (150 km/h; 92 mph). Optional medical evacuation unit and SAR fittings. LPG-150M winch for cargo loading; optional SLG-300 300 kg (661 lb) external SAR winch above port, forward door. Various search lights, loudspeakers and EO sensor turrets may be installed. Optional Bristol Aerospace cable-cutters.

ARMAMENT: Optional armament on two external pylons. Typical loads include UPK-23-250 23 mm cannon pods, 500 kg bombs and rocket pods.

DIMENSIONS, EXTERNAL:

Main rotor diameter	21.295 m (69 ft 10½ in)
Main rotor blade chord	0.52 m (1 ft 8½ in)
Tail rotor diameter	3.91 m (12 ft 9 7⁄8 in)
Length: overall, rotors turning	25.31 m (83 ft 1¼ in)
fuselage	18.99 m (62 ft 3½ in)
Width over weapon pylons	7.20 m (23 ft 7½ in)
Tailplane span	3.705 m (12 ft 1¾ in)
Height: overall, rotors turning	5.545 m (18 ft 2¼ in)
to top of rotor head	4.865 m (15 ft 1½ in)



Kazan/Mil Mi-17V-5

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Kazan-built Mil Mi-17V-5 in Chinese Army service

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Wheel track: main	4.51 m (14 ft 9½ in)
nose	0.30 m (11¾ in)
Wheelbase	4.28 m (14 ft 0½ in)
Fwd passenger door (stbd): Height	1.405 m (4 ft 7¼ in)
Width	0.825 m (2 ft 8½ in)
Fwd passenger door (port): Height	1.405 m (4 ft 7¼ in)
Width	1.215 m (3 ft 11¾ in)
Rear cargo ramp: Height	1.56 m (5 ft 1½ in)
Width	2.30 m (7 ft 6½ in)
DIMENSIONS, INTERNAL:	
Cabin: Length at floor	5.34 m (17 ft 6¼ in)
Width: at ramp	2.34 m (7 ft 8¼ in)
max	2.60 m (8 ft 6¼ in)
Height	1.80 m (5 ft 10¾ in)
Volume	23.0 m³ (812 cu ft)
AREAS:	
Main rotor disc	356.16 m² (3,833.7 sq ft)
Tail rotor disc	12.01 m² (129.28 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty, equipped	7,468 kg (16,464 lb)
Max payload:	
internal	4,000 kg (8,820 lb)
external, on sling	4,500 kg (9,920 lb)
Max T-O weight: TV3 engines	13,000 kg (28,660 lb)
VK-2500 engines	13,500 kg (29,762 lb)
Max disc loading	36.5 kg/m² (7.48 lb/sq ft)
PERFORMANCE (TV3-117VM engines):	
Never-exceed speed (VNE)	162 kt (300 km/h; 186 mph)
Max level speed	135 kt (250 km/h; 155 mph)
Max cruising speed	124 kt (230 km/h; 143 mph)
Econ cruising speed	70 kt (130 km/h; 81 mph)
Max forward rate of climb at S/L	624 m (2,047 ft)/min
Service ceiling: TV3	6,000 m (19,680 ft)
VK-2500	6,500 m (21,320 ft)
Hovering ceiling, OGE: TV3	3,980 m (13,055 ft)
VK-2500	4,500 m (14,760 ft)
Range with 5% reserves:	
with 4,000 kg (8,820 lb) payload	189 n miles (350 km; 217 miles)
ferry: normal fuel	386 n miles (715 km; 444 miles)
with max cabin fuel	890 n miles (1,650 km; 1,025 miles)

KAZAN ANSAT

English name: Light

TYPE: Light utility helicopter.

PROGRAMME: Design begun at Kazan in 1993; design subcontracts to Kazan State Technical University for structural strength and aerodynamic calculations; Aviacon Scientific and Production Centre for rotor; and Aeromekhanika for transmission. Name in Tatar language variously translated as *easy*, *simple*, *ethereal* and *light*.

Fuselage mockup exhibited at 1995 Paris Air Show; considerably revised engineering mockup (001) at Paris '97; by August 1998, now marked '01', this had accumulated 10 hours of ground running with engines and rotors; total 800 hours by February 2003.

First flight scheduled for late 1997, but initial designated flight trials aircraft (02) exhibited at Farnborough in September 1998, still unflown. First flight (02) was 12 minute hover on 17 August 1999; initial forward flight on 6 October 1999. Trials halted in November 1999, after 4 hours, due to gearbox problems; resumed in second quarter of 2000 with strengthened and redesigned main transmission, scarfed engine exhausts and new identity '902'. Total 120 hours up to February 2003.

Third (second flying) prototype (03) was to have joined the programme in late 1999, but not completed until August 2001. First flown 27 December 2001, this is to pre-production standard with small, detachable, pannier tanks, increased fin area, PW207 engines, additional side window and flatter windscreen combined with revised nose shape; intended to add 400 hours to trials programme. Certification flight testing, to total 600 sorties, began 31 October 2002; by early 2003 had been renumbered '904' and received modifications including relocation of fuel tanks under cabin floor; rear landing gear bow partly housed



Prototype Kazan Ansat-UT military trainer

1159020

within fuselage and front bow protected by cowling. Total 300+ sorties and 200+ hours by termination of trials in June 2004.

Russian AP-29 type certificate awarded 29 December 2004, amended 24 February 2005 to include two-crew operation and fitment of emergency flotation system.

On 14 September 2001, Ansat declared winner of competition to supply 100 training helicopters to Russian armed forces by 2015 (beating Mi-34 and Ka-226). Launch of production announced 27 September 2004; first for military use rolled out some days later, but apparently had not flown by mid-2005.

CURRENT VERSIONS: Can be optimised for transport (including underslung load), ambulance, SAR, training, patrol and other duties. Provision for attachment of spars or tanks to sides of cabin.

Ansat: As described.

Ansat-UT: Optimised for training (*uchebni*). Aircraft No. 5 (fourth prototype) completed as UT and delivered to flight test unit on 1 April 2004. Skid landing gear appeared in early photographs; not stated if flown thus; by late 2005 was flying with intended tricycle gear.

Ansat-AG: Version for Gazprom pipeline inspection.

Ansat-LL: Flying laboratory. (RA-)20440 shown at Moscow Salon in August 2005 outfitted for avionics trials by Radar-MMS company.

Ansat 2RTs: Previously known as **Ansat Nablyudatel** (Ansat Observation). Mockup of proposed scout helicopter based on Ansat was shown at Moscow Salon in August 2001. GOES 521 turret in nose with Svisch sensors integrated by Optool ZAO. Max useful load 1,500 kg (3,307 lb); max T-O weight 3,500 kg (7,716 lb); max level speed 162 kt (300 km/h; 186 mph); range 350 n miles (650 km; 403 miles) on internal fuel, 691 n miles (1,280 km; 795 miles) with external tanks; service ceiling 5,700 m (18,700 ft); hovering ceiling 3,800 m (12,460 ft). Powered by two PW207K turboshafts, each rated at 522 kW (700 shp).

Prototype of a considerably revised design constructed from dynamic systems (including P&WC engines) of Ansat '902', retaining that aircraft's identity. First flew July 2005 and exhibited in flying display at Moscow Salon during following month, having changed designation (as applied to side of fuselage) from -2R to -2RTs during that short period.

Intended for export, with South Korea as target launch customer. Twin stabilising fins are sole obvious external connection with original Ansat. Weapons on four pylons attached to stub wings; GOES 521 chin turret; Kord 12.7 mm machine gun scabbled to starboard side of fuselage; UV-26 chaff/flare dispensers mounted internally, each side of mid-fuselage. Pilot in rear of tandem seats; acrylic (unarmoured, curved) transparencies.

CUSTOMERS: Initial export customer, South Korean forestry service, first three received in December 2004 and total of five by late 2005, with sixth due in 2006. One on order for Tatarstan Airline in 2005.

COSTS: USD2.0 million for utility version (2003). Kazan's development expenditure had reached RUR500 million by mid-2004, with expected RUR100 million required for completion of certification.

DESIGN FEATURES: Optimised for aerodynamic efficiency, survivability in emergency landing (1 m; 3 ft/s power-off touchdown speed) and off-base routine maintenance. Traditional metal structure for simplicity and reliability. Meets FAR Pt 29 Category A and Russian AP-29 requirements. First Russian helicopter with shock-absorbing seats for passengers. Conventional configuration, with high-mounted tailboom carrying fixed horizontal stabiliser and twin fins; power plant above cabin. Hingeless main rotor hub with glass fibre torsion bar; forward inclination 4° 30'; four main blades; two-blade tail rotor. Two-stage, VR-23 main rotor reduction gear in magnesium case ahead of engines; ratio 16.4; rotation speed 365.4 rpm; blade tip speed 220 m (722 ft)/s. Transmission rating 769 kW (1,031 shp).



Kazan Ansat of South Korean forestry service

1159022



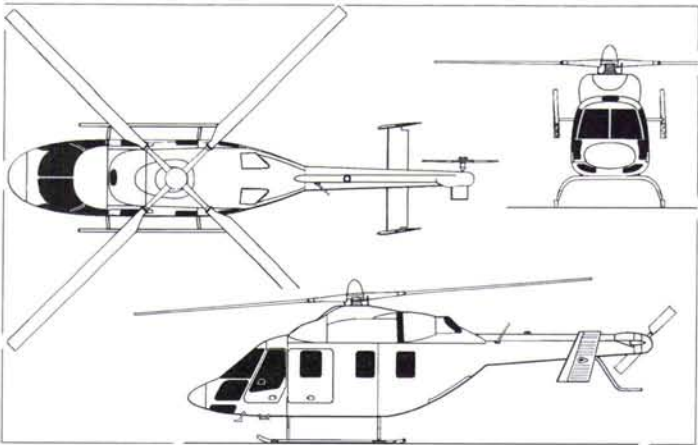
Exploded cutaway view of Kazan Ansat

1159021



Attack-optimised Kazan Ansat-2RTs (Yefim Gordon)

1159023



Kazan Ansat light utility helicopter (Paul Jackson)

1128982

Tail rotor speed 2,000 rpm via single stage conical gearbox. Rotor brake. Manual blade folding.

Main rotor aerofoil section NACA 23012.

STRUCTURE: Duralumin fuselage; sparing use of composites for cowlings, doors and hatches; layered glass fibre main rotor blades, window frames and nosecone.

LANDING GEAR: Twin skids with Kazan transverse shock-absorbers; tail bumper to protect anti-torque rotor. Wheels optional; tricycle configuration, with Yaroslav tyres and Hidroagregat (Balashikha) brakes. Optional emergency flotation system.

POWER PLANT: Two P&W Rus XRK206S turboshafts, each rated at 477 kW (640 shp) for T-O, 418 kW (560 shp) max continuous, in prototypes. Production version with PW207Ks, rated at 470 kW (630 shp) for T-O, 410 kW (550 shp) max continuous, 529 kW (710 shp) for 30 s, 470 kW (630 shp) continuous OEI and 491 kW (659 shp) 2 minutes OEI. FADEC standard. Fuel capacity 707 litres (187 US gallons; 156 Imp gallons) in either external panniers or underfloor. Optional internal ferry fuel.

Alternatively, two Salyut TV-500A turboshafts, each 478 kW (641 shp).

ACCOMMODATION: Up to 11 persons, including one or two pilots, on energy-absorbing seats; or two stretcher patients and three attendants; or internal or externally slung freight. Two forward-hinged doors each side of flight deck; two forward-hinged doors each side of cabin, forward; baggage bay behind cabin, with rear-facing door. Baggage door also used for loading stretchers of medical variant. Accommodation ventilated and heated; optional air conditioning.

SYSTEMS: Avionika FBW controls comprise quadruplex electronic system and duplex hydraulic system. Automatic flight control is standard on all piloting functions and optional

on navigation functions. Current FBW system to be replaced by Moscow Research & Production Complex Avionika KSU-A four-channel digital-analogue control system. Main transmission drives two alternators (each 200 V, 400 Hz), two generators (each 27 V), two fans and two hydraulic fuel pumps for separate systems. Electrical system 27 V, with battery; optional AC system, with second battery. Electric de-icing optional.

AVIONICS: Standard Russian avionics and instruments (apart from prototypes' BAE Systems North America engine parameters display, which to be replaced by Ulyanovsk BISK-A system); full Western avionics fit available as an option.

Radar: Provision in nosecone.

EQUIPMENT: Cabin tie-down points. Optional rescue hoist and sling.

ARMAMENT: Optional external rocket and machine gun pods.

DIMENSIONS, EXTERNAL:	
Main rotor diameter	11.50 m (37 ft 8¾ in)
Main rotor blade chord	0.32 m (1 ft 0½ in)
Tail rotor diameter	2.10 m (6 ft 10½ in)
Length: overall, rotors turning	13.64 m (44 ft 9 in)
Fuselage	11.18 m (36 ft 8¼ in)
Height to top of rotor head	3.56 m (11 ft 8¼ in)
Width: fuselage	1.80 m (5 ft 10¾ in)
over optional sponsons	3.61 m (11 ft 10¼ in)
Skid length	3.10 m (10 ft 2 in)
Skid track	2.50 m (8 ft 2½ in)
DIMENSIONS, INTERNAL:	
Cabin: Length	3.17 m (10 ft 4¾ in)
Max width	1.66 m (5 ft 5¼ in)
Max height	1.30 m (4 ft 3¼ in)
Volume	6.7 m³ (237 cu ft)

AREAS:	
Main rotor disc	103.87 m² (1,118.0 sq ft)
Tail rotor disc	3.46 m² (37.28 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty, equipped	1,900 kg (4,189 lb)
Max fuel weight	540 kg (1,190 lb)
Max payload: internal	1,000 kg (2,204 lb)
external	1,300 kg (2,866 lb)
T-O weight, internal or external load:	
normal	3,000 kg (6,613 lb)
max	3,300 kg (7,275 lb)
Max disc loading	31.8 kg/m² (6.51 lb/sq ft)
Transmission loading at max T-O weight and power	4.29 kg/kW (7.06 lb/shp)

PERFORMANCE:	
Never-exceed speed (VNE)	148 kt (275 km/h; 170 mph)
Max level speed	148 kt (275 km/h; 171 mph)
Max cruising speed	135 kt (250 km/h; 155 mph)
Max rate of climb at S/L	780 m (2,559 ft)/min
Max rate of climb at S/L, OEI	240 m (787 ft)/min
Service ceiling	5,700 m (18,700 ft)
Service ceiling, OEI	2,600 m (8,540 ft)
Hovering ceiling, OGE	3,300 m (10,820 ft)
Range: with 5% reserves	286 n miles (530 km; 329 miles)
Endurance	3 h 20 min

KAZAN AKTAI

English name: White Colt

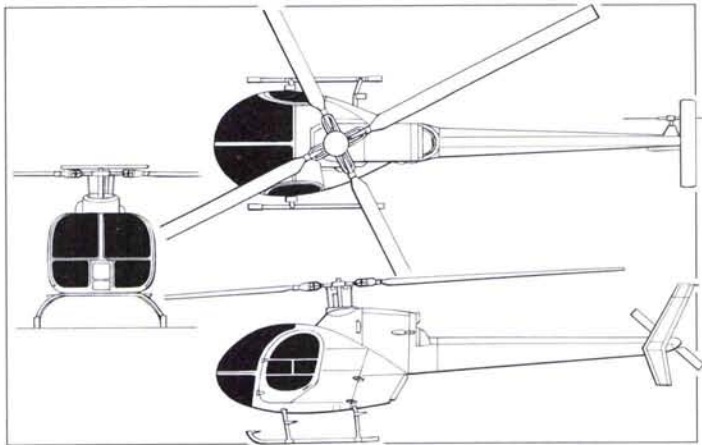
TYPE: Three-seat helicopter.

PROGRAMME: Work began 1996. Project revealed at Moscow Air Show, 19 August 1997, with display of mockup. Second, engineering mockup built 1998. Kazan decided in mid-2001 to begin building a prototype to fly in 2003, but the programme suffered delay and no further progress was evident by mid-2006.



Mockup of Kazan Aktai (Yefim Gordon)

1129423



Kazan Aktai light helicopter (James Goulding)

0131345

CURRENT VERSIONS: Passenger, medical, evacuation and military configurations planned.
COSTS: "Less than USD950,000" (2003). Estimated (2000) market for over 1,000.
Development cost (2000) USD10 million.

DESIGN FEATURES: Intended for light transport, patrol, medical evacuation and training. Certification will be to FAR Pt 27. Conventional pod and boom configuration with T tail. Semi-articulated three-blade main rotor; tapered blades on production version; max (emergency) rotation speed 2,586 rpm; rotor brake; no provision for folding; Krasnyy Otkryabr VR-10 main gearbox, transmission rating 216 kW (290 hp); engine input 6,000 rpm, XP-10 gearbox for two-blade tail rotor.

STRUCTURE: Extensive use of composites throughout, including main rotor blades.
LANDING GEAR: Conventional, non-retractable skids on arched support tubes; spring shock absorption.

POWER PLANT: One 201 kW (270 hp) VAZ-4265 rotary motorcar engine mounted above the cabin and behind the gearbox and operating on 92/93 grade petrol. Manual rpm control. Fuel capacity 300 litres (79.2 US gallons; 66.0 Imp gallons). Refuelling point port side. Oil capacity 20 litres (5.3 US gallons; 4.4 Imp gallons).

ACCOMMODATION: Pilot and two passengers, all side by side, in individual seats; forward-hinged door each side. Twin clamshell doors at rear of pod, below tailboom, provide access to flat freight floor; one casualty stretcher can be loaded through rear doors when passenger seat is removed. Alternative access via door (including circular window) on starboard side. Optional, rear-facing seat in luggage bay. Optional heating and air conditioning.

SYSTEMS: Electrical system with accumulator and M-16 generator, max rating 16 kW. Anti-icing of main rotor blades.
AVIONICS: Comms: Yurok radio.

Flight: KG-1B navigation system; GPS.
EQUIPMENT: Inset toe-steps for maintenance access.

DIMENSIONS, EXTERNAL:	
Main rotor diameter	10.00 m (32 ft 9 3/4 in)
Main rotor blade mean chord	0.24 m (9 1/2 in)
Tail rotor diameter	1.60 m (5 ft 3 in)
Length overall, rotors turning	11.64 m (38 ft 2 1/4 in)
Fuselage: Length	8.35 m (27 ft 4 3/4 in)
Max width	1.70 m (5 ft 7 in)
Max height	1.48 m (4 ft 10 3/4 in)
Height overall	2.69 m (8 ft 10 in)
Tailplane span	1.44 m (4 ft 8 3/4 in)
Skid track	2.10 m (6 ft 10 3/4 in)
Passenger doors, both:	
Max height	1.00 m (3 ft 3 1/4 in)
Max width	0.80 m (2 ft 7 1/2 in)
Baggage door, starboard:	
Max height	0.60 m (1 ft 11 1/2 in)
Max width	0.70 m (2 ft 3 1/2 in)
DIMENSIONS, INTERNAL:	
Cabin: Length	1.20 m (3 ft 11 1/4 in)
Max width	1.70 m (5 ft 7 in)
Floor area	2.80 m ² (30.1 sq ft)
Volume	4.0 m ³ (141 cu ft)
Freight compartment: Length	1.20 m (3 ft 11 1/4 in)
Max width	1.00 m (3 ft 3 1/4 in)

Max height	1.48 m (4 ft 4 in)
Volume	2.8 m ³ (99 cu ft)
AREAS:	
Main rotor blades, each	0.99 m ² (10.66 sq ft)
Tail rotor blades, each	0.11 m ² (1.18 sq ft)
Main rotor disc	78.54 m ² (845.4 sq ft)
Tail rotor disc	2.01 m ² (21.64 sq ft)
Fins, each	0.40 m ² (4.31 sq ft)
Tailplane	0.35 m ² (3.77 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	605 kg (1,334 lb)
Max payload	300 kg (661 lb)
Max T-O weight: normal	1,050 kg (2,314 lb)
max	1,150 kg (2,535 lb)
Max disc loading	14.64 kg/m ² (3.00 lb/sq ft)
Max power loading	5.71 kg/kW (9.39 lb/hp)
PERFORMANCE (estimated):	
Never-exceed speed (VNE)	102 kt (190 km/h; 118 mph)
Max level speed at S/L	97 kt (180 km/h; 112 mph)
Econ cruising speed	84 kt (155 km/h; 96 mph)
Max rate of climb at S/L	336 m (1,102 ft)/min
Service ceiling	4,700 m (15,420 ft)
Hovering ceiling: OGE	1,300 m (4,260 ft)
Range with 5% reserves	216 n miles (400 km; 248 miles)
Endurance	3 h

KAZAN ANSAT 3 MAKSIMUM

English name: Maximum

TYPE: Medium transport helicopter.

PROGRAMME: Initial details released, and cabin mockup shown, at Moscow Salon in August 2003. To be certified to AP-29 civil standards.

DESIGN FEATURES: Development of Ansar into medium helicopter category with stretched cabin and tailfin. Various shown with four- and five-blade main rotor; and two-, three- and X-blade tail rotor.

POWER PLANT: Two turboshaft engines mounted above cabin. Option of 956 kW (1,282 shp) RD-600, 1,103 kW (1,479 shp) VK-1500 or 736 kW (987 shp) VK-800.

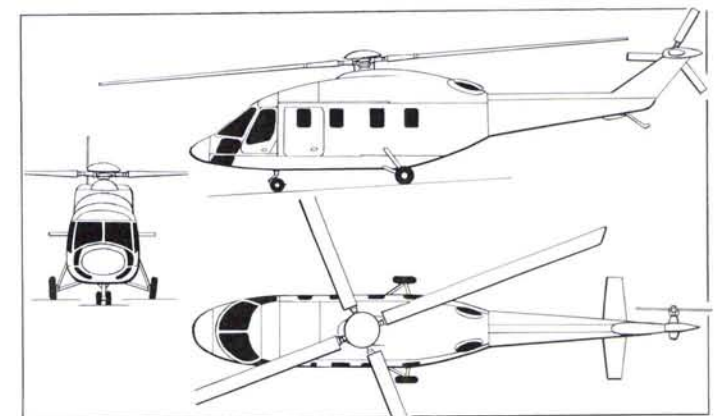
ACCOMMODATION: Two flight crew and up to 17 passengers on troop seats in cabin.

DIMENSIONS, EXTERNAL:	
Main rotor diameter	14.50 m (47 ft 6 3/4 in)
Tail rotor diameter	2.70 m (8 ft 10 3/4 in)
Fuselage max width	1.80 m (5 ft 10 3/4 in)
Height to top of fin	3.73 m (12 ft 2 3/4 in)
Tailplane span	2.85 m (9 ft 4 1/4 in)
Wheel track	2.83 m (9 ft 3 1/2 in)
Wheelbase	3.55 m (11 ft 7 3/4 in)
DIMENSIONS, INTERNAL:	
Cabin floor area	8.95 m ² (96.3 sq ft)
AREAS:	
Main rotor disc	165.10 m ² (1,777.1 sq ft)
Tail rotor disc	5.72 m ² (61.57 sq ft)



Model of Kazan Ansar 3 Maksimum (Paul Jackson)

1159068



Ansar 3 Maksimum medium helicopter (James Goulding)

0576723

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jawa.janes.com

WEIGHTS AND LOADINGS:

Max payload	1,700 kg (3,748 lb)
Max T-O weight	5,678 kg (12,517 lb)
Max disc loading	34.4 kg/m ² (7.04 lb/sq ft)

PERFORMANCE:

Max level speed	151 kt (280 km/h; 174 mph)
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Normal cruising speed	135 kt (250 km/h; 155 mph)
Hovering ceiling: IGE	5,000 m (16,400 ft)
OGE	3,500 m (11,480 ft)
Service ceiling	more than 6,000 m (19,680 ft)
Range with 30 min reserves	more than 459 n miles (850 km; 528 miles)

KHRUNICHEV

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The Aviation Department of this prominent rocket and space vehicle design and manufacturing centre was formed in August 1994 to develop and manufacture general purpose aircraft. It comprises a design bureau, experimental facilities and operational and maintenance services. The main task of the Aviation Department is to develop to the series production stage aircraft designed on the basis of foreign and domestic components, and then to market them worldwide.

The T-411 Aist (in production, notably for the export market) and the T-501 are priority programmes, according to an announcement of April 2004. This also confirmed suspension of the T-440 Mercury turboprop twin and the relegation of various agricultural aircraft to the longer term, though these remain available, subject to customer interest. Several other designs have failed to progress beyond the mockup or prototype stage, including the T-21, T-415 and T-507. In 2005, details of the T-207 were released.

During 2001, the company launched a joint venture with Sherpa Aircraft of the USA to market the T-411 in North America. It also builds Sherpa 200 and 300 airframes for distribution in the US, manufacture of the first '200 having begun in June 2003.

KHRUNICHEV T-205 and T-207

TYPE: Light utility turboprop.
PROGRAMME: Announced 2005.
CURRENT VERSIONS: **T-205:** Tailwheel version, intended for use on unprepared landing strips.
T-207: Basic version, *as described*.

DESIGN FEATURES: Conventional strut-braced, high-wing monoplane with STOL performance and fixed landing gear; intended for multiple missions, including search and rescue, parachuting, firefighting and pilot training. Superficially similar to company's T-507 Skvoretz. Interior allows carriage of LD3 containers; underfuselage cargo pod can be fitted. Wing aerofoil P-II-14 with 14 per cent thickness-chord ratio.

FLYING CONTROLS: Conventional and manual. Trim tab in elevator. Slotted flaps and ailerons. Dorsal fin.
STRUCTURE: All-metal. Fuselage has fixed bulkhead with door between cockpit and passenger cabin.
LANDING GEAR: T-205 has tailwheel; T-207 is of tricycle type; both fixed. Steerable nosewheel on T-207. Floats and skis optional.
POWER PLANT: One 969 kW (1,300 shp) P&WC PT6A-65 turboprop, driving a Hartzell five-blade, variable-pitch propeller.
ACCOMMODATION: Pilot and up to nine passengers for flights under FAR Pt 23 rules; maximum capacity two pilots and 12 passengers. Large cargo door on port side.
SYSTEMS: Engine-driven alternator with back-up battery. Electric starter.

All data are provisional.

DIMENSIONS, EXTERNAL:

Wing span	20.00 m (65 ft 7½ in)
Length overall	15.00 m (49 ft 2½ in)
Propeller diameter	2.82 m (9 ft 3 in)
Cargo door: Height	1.53 m (5 ft ¼ in)
Width	1.46 m (4 ft 9½ in)

DIMENSIONS, INTERNAL:

Underfuselage pod volume	3.00 m ³ (106 cu ft)
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WEIGHTS AND LOADINGS:

Max fuel weight	1,280 kg (2,822 lb)
Max T-O weight	5,700 kg (12,566 lb)
Max power loading	5.88 kg/kW (9.67 lb/shp)

PERFORMANCE:

Normal cruising speed	175 kt (325 km/h; 202 mph)
T-O run	230 m (755 ft)
T-O to 15 m (50 ft)	430 m (1,411 ft)
Landing from 15 m (50 ft)	500 m (1,640 ft)
Landing run	160 m (525 ft)
Range	890 n miles (1,650 km; 1,025 miles)

KHRUNICHEV T-411 AIST

English name: Stork
TYPE: Utility kitbuilt.
PROGRAMME: Programme started in 1994 when licence acquired from Aeroprogress/ROKS-Aero to produce the T-411 Aist-2 (see 1997-98 and previous editions); Aist-2 design started September 1992; construction of prototype began April 1993; first flight (marked only 'T-411') 10 November 1993 in standard form; 15 March 1994 with ski landing gear. Khrunichev prototype (RA-01585), with several detail changes, first exhibited at Moscow Air Show 1997. Second prototype reported nearing first flight in January 2002. Initially designated T-411 Wolverine, which name later transferred to T-421. North American promotion (in kit form) taken over by Sherpa Aircraft in 2001 and first two (unassembled) kits for US market were displayed at AirVenture, Oshkosh, in July 2003.

Manufacture intended by RSK 'MiG', whose Voronin plant contracted in March 2000 to build 15 for delivery in 2001, but delivery target slipped to first quarter 2002, with all 15 to be handed over during following six months. However, by June 2002, talks between Khrunichev and RSK 'MiG' still had not reached a satisfactory conclusion, although first aircraft then nearing completion. Nothing further known.

In November 2003, Khrunichev reached agreement with Infrakos of Kazakhstan to produce T-411s at Baikonur, where the RSK-assembled aircraft will be completed. Certification was then expected by end 2004. At the same time an improved version with 2,500 kg (5,511 lb) max T-O weight and undisclosed increased fuel capacity was under consideration. By March 2003, deliveries were stated to be due for completion by end 2003, but this slipped and only two were delivered (in kit form) that year with the remaining 13 scheduled for delivery during 2004.

CURRENT VERSIONS: **T-411:** *As described*.
T-411A: Agricultural version.
T-411P: Floatplane version with twin floats, for operations in seas with wave height up to 0.35 m (1 ft ½ in); length overall 10.00 m (32 ft 9¾ in); maximum take-off weight 1,650 kg (3,637 lb); payload 440 kg (970 lb); cruising speed 113 kt (210 km/h; 130 mph); T-O run 315 m (1,033 ft); T-O to 15 m (50 ft) 475 m (1,558 ft); landing from 15 m (50 ft) 305 m (1,000 ft); landing run 195 m (640 ft); maximum range 607 n miles (1,125 km; 699 miles).
T-411F: As T-411P, but with amphibious floats.
T-411L: Ski-equipped version.
T-411LY: Textron Lycoming TIO-540 powered version, see Power Plant below.
T-411 Turbo: Walter M 601B turboprop. Incomplete prototype shown in Moscow, August 2001. An upgraded M 601E-powered example has also been mooted.
T-421: Described in 2001-02 *Jane's All the World's Aircraft*.

CUSTOMERS: Orders received from Russian forestry, fisheries and national emergency ministries, Australia, Malaysia and US, but only three US aircraft identified: c/n 63101 registered to Wesley Gordon, of Scappoose, Oregon, December 2003 as N411RK and shown at Airventure, Oshkosh, July 2006; and kits c/n 63102 and one other, marked '002', neither of which had been completed by mid-2006.

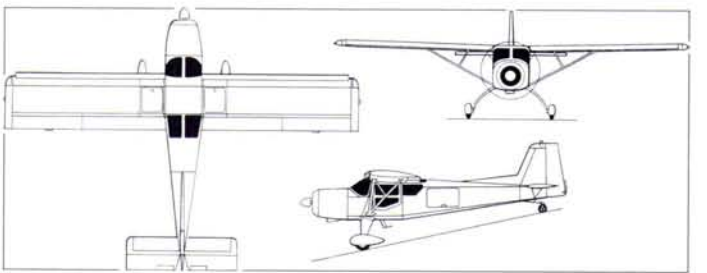
COSTS: Kit USD90,000 (2006) not including engine.
DESIGN FEATURES: Conventional strut-braced high-wing monoplane. Constant-chord unswept wings with fixed leading-edge slat, slotted ailerons and single-slotted, three-position (0, 20, 40°) trailing-edge flaps; V bracing struts. Rectangular-section fuselage. Unswept tail unit with dorsal fin; constant-chord horizontal tail surfaces. Compared with the Aeroprogress Aist-2, the Khrunichev version has slightly stretched airframe and more roomy cabin; different landing gear and power plant.

Wing section NACA 23011; dihedral 2° from root; incidence 3° 30'.
FLYING CONTROLS: Conventional and manual. Actuation by pushrods and cables; electrically controlled trim tab in each elevator; fixed full-span leading-edge slats; slotted flaps.



First Khrunichev T-411 Aist in US (Paul Jackson)

1158591



Khrunichev T-411 Aist four/five-seat light aircraft (James Goulding)

STRUCTURE: Fuselage structure of 4130 steel tube covered with Dacron synthetic fabric and (cabin and engine cowling) aluminium alloys. Two-spar, constant-chord wings: metal skin on leading-edge and over fuel tanks at root, Dacron covered between spars. Metal tail surfaces, Dacron covered.

LANDING GEAR: Tailwheel type: fixed. Fuselage-mounted spring steel cantilever mainwheel legs with wheel fairings. Self-centring castoring tailwheel. Mainwheel tyres 600x180; tailwheel 310x135. Brakes on mainwheels.

POWER PLANT: One 268 kW (360 hp) VOKBM M-14X or M-14Kh nine-cylinder radial with Mhlbauer MTV-9 three-blade variable-pitch propeller, or 261 kW (350 hp) Textron Lycoming TIO-540 flat-six with Hartzell three-blade variable-pitch propeller. Two main and two auxiliary fuel tanks in wingroots, total capacity 340 litres (89.8 US gallons; 74.8 Imp gallons); gravity fuelling. Oil capacity 22.0 litres (5.8 US gallons; 4.8 Imp gallons).

ACCOMMODATION: Pilot and three or four passengers, on side-by-side front seats and rear bench seat: starboard front seat and rear bench removable, or bench seat foldable, for carrying equivalent freight; convertible into ambulance for one stretcher patient, one seated casualty and medical attendant in addition to pilot. Dual controls standard. Baggage/cargo compartment aft of rear seats, with large upward-opening door on port side, used also for loading freight or stretcher. Forward-hinged jettisonable door each side of cabin. Ventilation and heating standard.

SYSTEMS: Pneumatic system for starting engine and operating mainwheel brakes; pressure 50 bar (725 lb/sq in). Electrical system includes GSR-3000M engine-driven 27 V DC generator and 28 Ah 12CAM-28 battery.

AVIONICS: Russian or Western (Honeywell) avionics available, including GPS. Optional autopilot.

DIMENSIONS, EXTERNAL:

Wing span	13.02 m (42 ft 8½ in)
Wing aspect ratio	7.0
Length overall	9.45 m (31 ft 0 in)
Height overall	2.60 m (8 ft 6¼ in)
Wheel track	2.59 m (8 ft 6 in)
Wheelbase	6.50 m (21 ft 4 in)
Propeller diameter	2.03 m (6 ft 8 in)
Baggage door: Max height	0.65 m (2 ft 1½ in)
Width	1.22 m (4 ft 0 in)

DIMENSIONS, INTERNAL:

Cabin: Length	2.94 m (9 ft 7½ in)
Max width	1.27 m (4 ft 2 in)
Max height	1.30 m (4 ft 3 in)

AREAS:

Wings, gross	24.30 m² (261.6 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	544 kg (1,200 lb)
Max payload	361 kg (795 lb)
Max fuel weight	255 kg (562 lb)
Max T-O weight	1,680 kg (3,703 lb)
Max wing loading	69.1 kg/m² (14.16 lb/sq ft)
Max power loading	6.27 kg/kW (10.30 lb/hp)

PERFORMANCE:	
Never-exceed speed (VNE)	151 kt (280 km/h; 174 mph)
Cruising speed	110 kt (204 km/h; 127 mph)
Stalling speed: flaps up	61 kt (112 km/h; 70 mph)
flaps down	51 kt (93 km/h; 58 mph)
Max rate of climb at S/L	444 m (1,457 ft)/min
Service ceiling	3,000 m (9,840 ft)
T-O run	85 m (279 ft)
Landing run	136 m (446 ft)
T-O to 15 m (50 ft)	210 m (690 ft)
Landing from 15 m (50 ft)	331 m (1,090 ft)
Range with max fuel	648 n miles (1,200 km; 745 miles)

KHRUNICHEV T-419 STREKOZA

English name: Dragonfly

TYPE: Agricultural sprayer.

PROGRAMME: Mockup shown at Moscow Salon, August 2001. (Designation **T-411SKh** has also been used). Reported in May 2002 that prototype to fly within a few months, but no further progress apparent by mid-2004; by May 2006, company was intending to fly prototype in 'Summer' 2006.

COSTS: USD100,000 (2002).

DESIGN FEATURES: Similar to company's earlier T-517 Farmer, using strut-braced high wing and underslung crew and payload pod. Intended for wide variety of uses, including passenger and cargo transportation, agricultural spraying, pipeline inspection and police and border guard patrols.

FLYING CONTROLS: Conventional and manual. Horn-balanced elevators and rudder. Flaps.

STRUCTURE: Principally of metal with external bracing.

LANDING GEAR: Tailwheel type: fixed.

POWER PLANT: One 268 kW (360 hp) VOKBM M-14X nine-cylinder radial engine. Fuel in two wing tanks.

ACCOMMODATION: Pilot and three passengers in cabin.

DIMENSIONS, EXTERNAL:

Wing span	13.20 m (43 ft 3¾ in)
Length overall	8.55 m (28 ft 0½ in)

WEIGHTS AND LOADINGS:

Max payload	420 kg (926 lb)
Max fuel weight	280 kg (617 lb)
Max T-O weight	1,700 kg (3,747 lb)
Max power loading	6.33 kg/kW (10.41 lb/hp)

PERFORMANCE:

Normal cruising speed	97 kt (180 km/h; 112 mph)
T-O run	90 m (295 ft)
T-O to 15 m (50 ft)	250 m (820 ft)
Landing from 15 m (50 ft)	280 m (919 ft)
Landing run	136 m (446 ft)
Range	594 n miles (1,100 km; 683 miles)



Khrunichev T-419 mockup (Paul Jackson)

0552718

KHRUNICHEV T-501**English name:** Dragonfly**TYPE:** Light utility turboprop.**PROGRAMME:** In April 2004, Khrunichev announced that it had assigned priority to

development of an extensively modified version of the Aeroprogress/ROKS-Aero T-101 Grach, which is now envisaged with two turboprop engines each of some 969 kW (1,300 hp); accommodation for up to 12 passengers; 2,700 n mile (5,000 km; 3,106 mile) range; and a price of USD1.2 million. Nothing further heard by mid-2006.

KNAAPO

**GOSUDARSTVENNOYE UNITARNOYE PREDPRIYATIE
KOMSOMOLSKOE-NA-AMURE AVIATIONNOYE
PROIZVODSTVENNOYE OBDINENIE IMENI YU A GAGARINA
(STATE UNITARY ENTERPRISE KOMSOMOLSK-ON-AMUR
AIRCRAFT PRODUCTION ASSOCIATION NAMED FOR Y A
GAGARIN)**

ulitsa Sovetskaya 1, 681018 Komsomolsk-na-Amure

Tel: (+7 42172) 762 00**Fax:** (+7 42172) 634 51 and 298 51**e-mail(1):** knaapo@kmscom.ru**e-mail(2):** knaapo@gin.ru**Web:** www.knaapo.ru**GENERAL DIRECTOR:** Viktor I Merkulov**TECHNICAL DIRECTOR:** Aleksandr I Pekarskh**FIRST DEPUTY DIRECTOR-GENERAL AND MANAGER OF CIVIL AIRCRAFT PRODUCTION:**

Vladislav B Kotovsky

DEPUTY DIRECTOR-GENERAL AND BUSINESS MANAGER: Alexandr Ovchinnikov

KNAAPO is the major manufacturer of the Su-family aircraft and leading production centre of Aviation Holding Company "Sukhoi". Manufactures Su-27SK, Su-27SKM, Su-30MK, Su-30MK2 and Su-33 fighters and is responsible for the RRJ, Su-80GP, Be-103, and SA-20P civil programs. Modernising Sukhoi Su-27 for Russian Air Forces; delivered initial aircraft on 23 December 2004. In September 2001 announced own SA-20P programme, being modified version of Be-103, with single engine; by late 2005 had 40 Be-103/SA-20Ps in various stages of assembly. In anticipation of market trends, will reduce reliance on military aircraft sales to 50 per cent by 2010.

Known as GAZ 126 when established in 1934, it has built more than 11,000 aircraft of

**KnAAPO-built Sukhoi Su-30MK during missile trials**

1159024

Ilyushin, Mikoyan-Gurevich and Tupolev types, including 3,000 exported to 20 countries, beginning in May 1936. Test airfield is Dzemgi. Other products include small aluminium boats, audio-video equipment, televisions, polygraphy equipment and wooden furniture, and refurbishment of trams. Operates own transport airline with four An-12s, one An-26, two An-32s, two (leased to Atlant-Soyuz) Il-76s, two Tu-134s and three Mi-8s.

KumAPP

**KUMERTSKOYE AVIATIONNOYE PROIZVODSTVENNOYE
PREDPRIYATIE
(KUMERTAU AVIATION PRODUCTION ENTERPRISE)**

ulitsa Novozarinskaya 15A, 453350 Kumertau, Respublika Bashkortostan

Tel: (+7 34761) 422 53 and 423 00**Fax:** (+7 34761) 439 13**Web:** www.kumape.ru**GENERAL DIRECTOR:** Boris S Malyshev**EXPORT DEPARTMENT:** R M Rafikov

KumAPP has manufactured helicopters, aeroplanes and related equipment at Kumertau since 1962. Major programmes have involved the Kamov Ka-26 (800 built 1968-79) and Ka-27/28/29/32 helicopter series, Myasishchev M-17/M-55, wings for the Tupolev Tu-154M

transport, and unmanned air vehicles including the Tu-243 Reis-D reconnaissance system. KAPP is the only manufacturer of carbon fibre/glass fibre rotor blades in the Russian Federation and Associated States (CIS).

Current production includes main rotor blades and associated bushes for the Ka-226. KumAPP built second and third prototype Ka-226s and contracted to build 10 for Moscow city government, although deliveries repeatedly postponed; and one for Bashkiriyan local government. Ka-32 remains in low-volume production at some five to 10 per year; Ka-31 previously manufactured for India. KumAPP has also been chosen to manufacture the Ilyushin Il-112 transport for the Russian Air Forces. Helicopter overhaul activities have included Indian Ka-28s.

The plant is to become part of the consortium led by RSK 'MiG' under aerospace restructuring plans announced by the Russian government in May 2001 and is due for privatisation. Employment in 2003 was 5,600. In 2004, KumAPP reported to be financially solvent, but still owing back pay to workforce.

LAPLAN

**LAPLAN OAO
(LAPLAN LTD)**

Ulitsa Bolshaya Cherkizovskaya 5-8, Moskva 107061

Tel: (+7 495) 739 37 80**Fax:** (+7 495) 739 37 81**PRESIDENT:** Alexey Lamanov

Established 2004 as division of Novye Transportnye Tekhnologii (New Transport Technology) financial and industrial group, itself formed in 1994, initially to supply the rail travel industry. Workforce of 100 in 2006, including specialists previously employed by Ilyushin, MiG and Sukhoi.

Initial designs, L-451 and L-471, exhibited at Moscow in August 2005. By 2006, L-551 and L-572 also under development.

LAPLAN L-451**TYPE:** Light utility transport.**PROGRAMME:** Prototype, (RA-)3367K, exhibited at Moscow in August 2005. To be certified to AP-23/FAR Pt 23.

DESIGN FEATURES: Rugged multipurpose design, carrying 400 kg (882 lb) payload, suitable for undeveloped areas. STOL performance; unsophisticated design; low purchase and operating costs, with options of kit assembly and Diesel power plant.

High-mounted, constant-chord wing braced to lower fuselage by streamlined V struts. Sweptback fin; mid-mounted tailplane braced below by V struts.

FLYING CONTROLS: Conventional and manual. Mass-balanced ailerons; horn-balanced rudder and elevators. Actuation by pushrods and cables. Tab on rudder; flight-adjustable tab in starboard elevator. Slotted flaps.

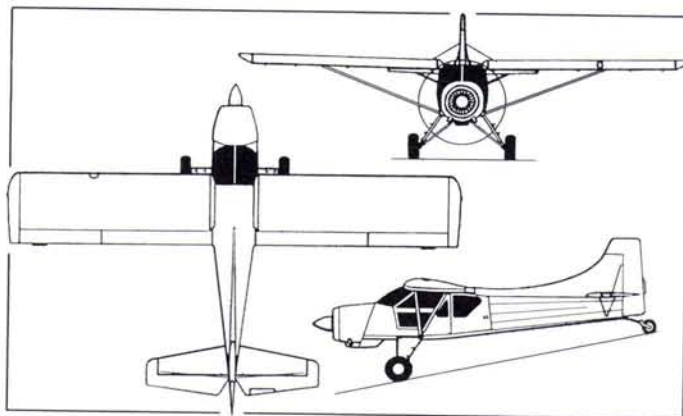
STRUCTURE: Welded tubular steel fuselage and two-spar metal wing; Stits fabric covering, except D16T metal forward fuselage and composites wingtips.

LANDING GEAR: Tricycle type; fixed. Faired-in side Vs hinged to lower longerons, with half-axles sprung on centreline. Mainwheels 800x260; steerable tailwheel.

POWER PLANT: One 265 kW (355 hp) VOKBM M-14X nine cylinder radial driving an MT-Propeller MTV-9 three-blade propeller. Optionally 231 kW (310 hp) Centurion Diesel engine. Twin fuel tanks in each wing, inboard; combined capacity 460 litres (121.5 US gallons; 101 Imp gallons).

ACCOMMODATION: Pilot, plus three passengers or equivalent freight. Upward-hinged door each side, forward; cabin door, port. Cockpit heated and ventilated.

SYSTEMS: Electrical system 28 V DC.

**Laplan L-451 light utility transport (Paul Jackson)**

1159398

AVIONICS: Comms: Garmin GNS 430 COM/GPS/VOR with GA 106 indicator and GMA 340 audio unit. ELS-110NM ELT.

Flight: S-Tec autopilot. Bendix/King KCS 55A navigation system with KI 525A indicator.

DIMENSIONS, EXTERNAL:

Wing span	13.50 m (44 ft 3½ in)
Wing aspect ratio	6.9
Length overall	9.60 m (31 ft 6 in)
Height overall	2.95 m (9 ft 8¼ in)
Tailplane span	5.20 m (17 ft 0¾ in)
Wheel track	2.80 m (9 ft 2¼ in)
Wheelbase	7.20 m (23 ft 7½ in)

DIMENSIONS, INTERNAL:

Cabin: Max width	1.24 m (4 ft 0¾ in)
Max height	1.20 m (3 ft 11¼ in)
Volume	4.2 m³ (148 cu ft)
Baggage area volume	0.65 m³ (23.0 cu ft)



Laplan L-451 on display at Moscow's MAKS air show, 2005 (Yefim Gordon)

1159319

AREAS:	
Wings, gross	26.50 m ² (285.2 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	1,250 kg (2,756 lb)
Max payload	400 kg (882 lb)
Max fuel weight	330 kg (728 lb)
Max T-O weight	1,850 kg (4,078 lb)
Max landing weight	1,800 kg (3,968 lb)
Max wing loading	69.8 kg/m ² (14.30 lb/sq ft)
Max power loading	6.98 kg/kW (11.49 lb/hp)
PERFORMANCE:	
Max level speed	127 kt (235 km/h; 146 mph)
Stalling speed	48 kt (88 km/h; 55 mph)
Max rate of climb at S/L	390 m (1,280 ft)/min
T-O to 15 m (50 ft)	375 m (1,230 ft)
Landing from 15 m (50 ft)	420 m (1,380 ft)
Range with 45 min reserves:	
with max payload	297 n miles (550 km; 341 miles)
ferry	1,052 n miles (1,950 km; 1,211 miles)
Endurance	10 h 20 min
g limits	+3.8/-1.5

parallel, streamlined struts each side, Sweptback fin; mid-mounted tailplane with V-strut bracing below. Single engine mounted on wing leading edge above cabin. Outrigger sponsons on cantilever booms each side of lower fuselage. Operable in wave heights up to 0.5 m (1½ ft).

FLYING CONTROLS: Conventional and manual. Actuation by pushrods and cables. Horn-balanced rudder and elevators. Trim tab on fin; flight adjustable tab in starboard elevator. Electrically actuated slotted flaps.

STRUCTURE: Generally of anodised aluminium, with some composites components. Hull divided into watertight compartments.

LANDING GEAR: Tricycle type; retractable. Mainwheels retract into sponsons; nosewheel into hull.

POWER PLANT: One 265 kW (355 hp) VOKBM M14P-XDK nine cylinder radial driving a two blade AB 81 propeller. Two fuel tanks in each wing, inboard, combined capacity 460 litres (121.5 US gallons; 101 Imp gallons).

ACCOMMODATION: Pilot and three or four passengers, or equivalent freight. Upward-hinged door each side, forward and port, rear. Accommodation heated and ventilated.

SYSTEMS: Engine powered electrical generator.

AVIONICS: *Flight:* Garmin GNS 530 GPS.

Comms: ELT 110-406 ELT.

DIMENSIONS, EXTERNAL:	
Wing span	13.50 m (44 ft 3½ in)
Wing aspect ratio	6.9
Length overall	11.80 m (38 ft 8½ in)
Height overall	4.10 m (13 ft 5½ in)
Tailplane span	5.00 m (16 ft 4¾ in)
Wheel track	3.00 m (9 ft 10 in)
Wheelbase	4.80 m (15 ft 9 in)

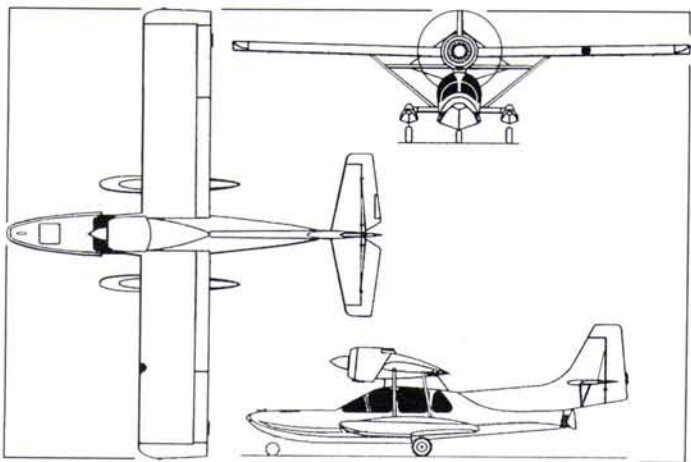
LAPLAN L-471

TYPE: Four-seat amphibian.
PROGRAMME: (RA-)3368K shown at Moscow in August 2005.
DESIGN FEATURES: Inexpensive utility transport for undeveloped areas, offering rough airfield and water operation. Two-step hull; constant chord wing mounted on cabane, braced by



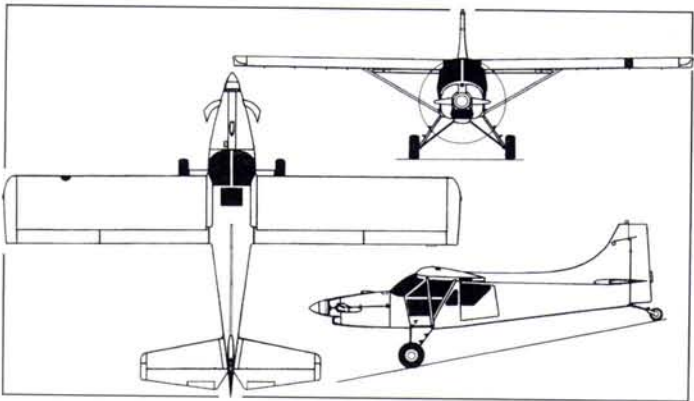
Laplan L-471 amphibian (Yefim Gordon)

1159320



General arrangement of Lapan L-471 (Paul Jackson)

1159399



Laplan L-551 turboprop utility transport (Paul Jackson)

1159400

T-O to 15 m (50 ft)	400 m (1,315 ft)
Landing from 15 m (50 ft)	290 m (955 ft)
Range	1,052 n miles (1,950 km; 1,211 miles)

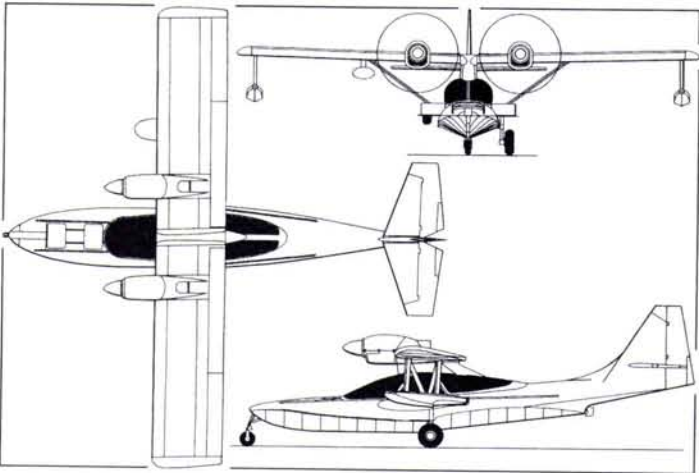
DIMENSIONS, INTERNAL:	
Cabin: Max width	1.20 m (3 ft 11¼ in)
Max height	1.00 m (3 ft 3¼ in)
Volume	2.0 m³ (70 cu ft)
Cargo bay volume	1.3 m³ (46 cu ft)
AREAS:	
Wings, gross	26.30 m² (283.1 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	1,350 kg (2,976 lb)
Max payload	400 kg (882 lb)
Max fuel weight	330 kg (728 lb)
Max T-O weight	1,950 kg (4,299 lb)
Max landing weight	1,900 kg (4,188 lb)
Max wing loading	74.1 kg/m² (15.19 lb/sq ft)
Max power loading	7.37 kg/kW (12.11 lb/hp)
PERFORMANCE:	
Max level speed	116 kt (215 km/h; 133 mph)
Stalling speed	49 kt (90 km/h; 56 mph)
Max rate of climb at S/L	390 m (1,280 ft)/min
T-O to 15 m (50 ft): land	395 m (1,295 ft)
water	470 m (1,545 ft)
Landing from 15 m (50 ft): land	485 m (1,595 ft)
water	225 m (740 ft)
Range with 45 min reserves:	
with max payload	237 n miles (440 km; 273 miles)
ferry	688 n miles (1,275 km; 792 miles)
Endurance	8 h 0 min
g limits	+3.8/-1.5

LAPLAN L-551

TYPE: Light utility turboprop.	
PROGRAMME: Details published 2006. None yet built.	
DESIGN FEATURES: Turboprop version of L-451.	
Principal differences as below.	
POWER PLANT: One 560 kW (751 shp) M 601 E turboprop driving an Avia V-510 five-blade variable pitch propeller. Five tanks in each wing centre section, combined capacity 1,040 litres (275 US gallons; 229 Imp gallons).	
ACCOMMODATION: Pilot and up to seven passengers.	
DIMENSIONS, EXTERNAL:	
Cabin: Length	2.45 m (8 ft 0½ in)
Max width	1.50 m (4 ft 11 in)
Max height	1.20 m (3 ft 11¼ in)
WEIGHTS AND LOADINGS:	
Max payload	750 kg (1,653 lb)
Max fuel weight	830 kg (1,830 lb)
Max T-O weight	2,700 kg (5,952 lb)
Max wing loading	101.9 kg/m² (20.87 lb/sq ft)
Max power loading	4.82 kg/kW (7.93 lb/shp)
PERFORMANCE:	
Max level speed	178 kt (330 km/h; 205 mph)

LAPLAN L-572

TYPE: Twin-turboprop amphibian.	
PROGRAMME: Under development by 2006.	
DESIGN FEATURES: Twin-turboprop derivative of L-471, with engines similarly mounted on wing leading-edge; broader beam; outrigger floats removed to wingtips.	
POWER PLANT: Two AI-450TP turboprop versions of Progress (ZMKB) AI-450 turboshaft, each 331 kW (443 shp). Fuel capacity 1,000 litres (264 US gallons; 220 Imp gallons).	
ACCOMMODATION: Pilot and seven passengers.	
AVIONICS: Radar: Optional podded radar under starboard wing.	
DIMENSIONS, EXTERNAL:	
Cabin: Length	2.45 m (8 ft 0½ in)
Max width	1.50 m (4 ft 11 in)
Max height	1.32 m (4 ft 4 in)
WEIGHTS AND LOADINGS:	
Max payload	780 kg (1,720 lb)
Max fuel weight	800 kg (1,763 lb)
Max T-O weight	3,000 kg (6,613 lb)
Max power loading	4.54 kg/kW (7.46 lb/shp)
PERFORMANCE:	
Max level speed	194 kt (360 km/h; 224 mph)
T-O to 15 m (50 ft): on land	420 m (1,380 ft)
on water	570 m (1,870 m)
Landing from 15 m (50 ft): on land	370 m (1,215 ft)
on water	520 m (1,710 ft)
Range with max fuel	853 n miles (1,580 km; 981 miles)



Laplan L-572 twin-turboprop amphibian (Paul Jackson)

1159401

MIG

INZHENIRNYI TSENTR "OKB IMENI A I MIKOYANA"
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DIRECTOR OF STRATEGIC PLANNING, INFORMATION AND MARKETING: Alexander I Ageev

CHIEF, PUBLIC RELATIONS AND ADVERTISING DEPARTMENT: Svyatoslav Yu Ribas

This bureau originated in GAZ 1 (factory No. 1) founded in 1893. The experimental design bureau, founded by Artem I Mikoyan, dissociated from the factory in 1939 and later became officially the Mikoyan Aviation Scientific-Industrial Complex 'MiG' (the final letter indicating Mikhail I Gurevich). It developed 250 projects and built 120 prototypes. More than 60,000 aircraft of MiG design have been manufactured, including 11,000 for export and MiG aircraft have at one time or another held 72 world records.

In 1995, the Moscow Aircraft Production Organisation and ANPK MiG were merged into the single state company MAPO 'MiG'. The original 'MiG' acronym continued to be used, though MiG lost its separate legal identity and was prevented from selling its own aircraft. On 4 July 1997 the legal status of MAPO 'MiG' was restored. Following a change of title, the bureau is now subordinate to RSK 'MiG', described separately.

Seeking to further its aerodynamic research, MiG proposed in late 2002 to return to airworthy condition the twice-flown 1.44 technology demonstrator, subject to interest and financial contribution by engine manufacturer, Saturn/Lyulka. A decision to proceed with further 1.44 testing was made in May 2004, although the announcement did not specify flight trials and none appeared to have taken place by mid-2006.

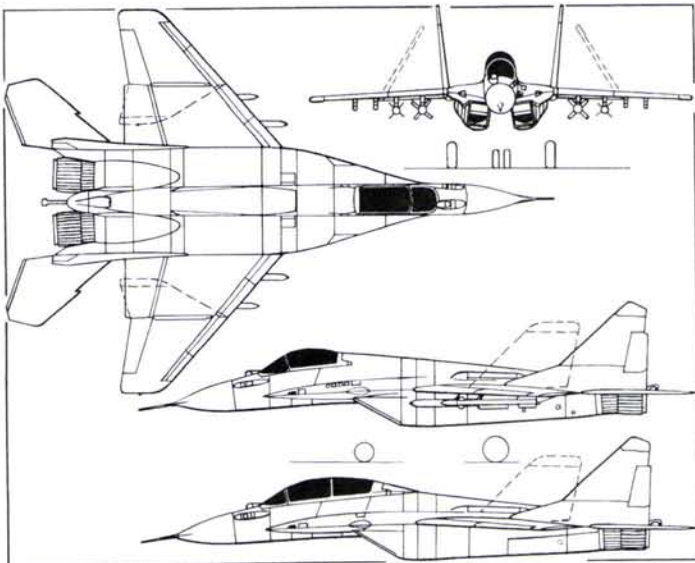
MiG-29 and MiG-35

NATO reporting name: Fulcrum

Indian Air Force name: Baaz (Eagle)

TYPE: Multirole fighter.

PROGRAMME: Production of land-based MiG-29s ended in mid-1990s after some 1,600 aircraft, leaving substantial stock of semi-complete airframes available to meet export orders. Most recently, Yemen received MiG-29SMTs and MiG-29UBT trainers in late 2004, this being



Navalised 'Fulcrums', the MiG-29K and side view (lower) of MiG-29KUB
(James Goulding)

1159402



MiG-29 OVT (MiG-35 proof-of-concept) displaying its agility (Paul Jackson)

1159372

the first delivery of these variants. Activity currently centres on upgrades for existing aircraft.

Prospects for new production were long dependent upon Indian order for carrier-based MiG-29K. By 2001 — in advance of formal order — MiG was constructing two pre-series MiG-29Ks, one MiG-29KUB and static test airframe in single-seat configuration. Sokol plant (described separately) contracted in 2001 to build folding wing and nose section for production aircraft.

Eventually, on 20 January 2004, contract signed with India for 12 MiG-29Ks and four MiG-29KUB two-seat trainers, worth in excess of US\$700 million, for delivery by 2007–08. Option exists for further 30 to be supplied by 2015. Production by LAPIK at Lkhovitsy. At time of contract signature, detailed technical specification still to be finalised.

Following data generally for MiG-29K. Earlier versions described in *Jane's Aircraft Upgrades*. However, Algeria reported in January 2006 to have purchased 36 MiG-29 SMTs and taken option on further 20; if new-build, these would require resumption of MiG-29 in its land-based form.

CURRENT VERSIONS: **MiG-29K: (Factory index 9.31; K for korabelnyy; ship-based)** Maritime version, used for ski-jump take-off and deck landing trials on carrier *Admiral of the Fleet Kuznetsov* (formerly *Thilisti*), beginning 1 November 1989; two new-build prototypes, using second-generation MiG-29M structure; completely redesigned, mainly steel, wing using modified aerofoil section and of increased area (increased span, reduced leading-edge sweep) with double slotted flaps, drooping flaperons and more powerful leading-edge flaps; new spar in front of original wing box; new strengthened centre-section without overwing louvres; upward-folding outer wing panels; RD-33K turbofans with 92.2 kN (20,723 lb st) contingency rating for ski-jump take-offs. Fuel capacity reduced to 5,670 litres (1,498 US gallons; 1,247 Imp gallons). First flown (16188 '311') 23 June 1988; second prototype was 27579 '312'.

State Acceptance Trials suspended due to funding difficulties, early 1992. Further development ended initially when not selected for deployment on *Admiral of the Fleet Kuznetsov*, but resumed at Zhukovsky in September 1996, in expectation of order from India. First prototype currently grounded; second returned to flight status in support of MiG-29M programme. Proposed naval **MiG-29KU** (9.62) trainer derivative with two separate stepped cockpits remained unbuilt.

'MiG-29K-2002': (Factory index 9.41) The original MiG-29SMTK (factory index 9.17K; effectively a MiG-29SMT with the 9.31's folding wing and landing gear), previously offered to India along with the former helicopter carrier *Admiral Gorshkov*, is understood to have been replaced by a new, multirole, carrierborne variant based more closely on the MiG-29KM, albeit without the expensive Al-Li alloys. Development of new MiG-29M variants (single- and two-seat) continued in 2003 with MiG-29OVT (thrust-vectoring ground testbed) and MiG-29M2 (29MRCA) which first flew on 26 September 2001 after conversion to tandem configuration.

With a MIL-STD-1553B-type bus and open systems avionics architecture, the MiG-29K-2002 is compatible with a wide range of Russian and Western weapons, and may feature the colour displays and GPS-based navigation system of the MiG-29SMT. This variant, possibly designated MiG-29 MTK, is claimed to be able to perform 90 per cent of its missions with a 10 kt (18 km/h; 11 mph) wind-over-deck, even in tropical conditions using new autothrottle. Notable features of the new aircraft are its improved wing with enlarged trailing-edge flaps, digital FBW system, emergency fuel draining and much-reduced folded span of 5.80 m (19 ft 0¼ in), achieved by positioning the fold line much closer in to the wingroot, and by adding upward-folding tailplanes. The aircraft can also fold its radome (up and back), reducing overall length to 14.13 m (46 ft 4¼ in). Accordingly, 44,570-tonne *Admiral Gorshkov*, which India has also purchased (as *INS Vikramaditya*), can carry a full air wing of 24 MiG-29Ks (plus six helicopters), or (according to some sources) as many as 30.

A projected **MiG-29K-2008** upgrade configuration could add Zhuk-MF phased-array radar, RD-133 turbofans, a computer upgrade and additional electro-optic, radar, IIR and reconnaissance pods, together with take-off performance improvements. In December 1999, it was reported that India had selected the MiG-29K for use aboard *Admiral Gorshkov*, with a quantity of Kh-35 anti-ship missiles and Kh-31P ARMs. Proposed local manufacture by HAL appears no longer to be viable.

MiG-29KUB: (Factory index 9.47) Revised carrier-borne two-seat trainer design offered to India, based on MiG-29K-2002 with reduced-span, inboard wing fold and folding tailplanes. Assumed to feature original stepped tandem cockpits of MiG-29KU. Some reports suggest enlarged tailfins with integral fuel tanks.

MiG-35: Most recent use of this designation adopted in 2005 when MiG-29OVT upgrade was redesignated for possible new manufacture in India to meet local requirement for 126 aircraft. Offers high commonality with Indian Navy aircraft; RD-33MK thrust vectoring engines; and electronically scanned radar.

DESIGN FEATURES: Emphasis from start on high manoeuvrability, to counter US F-15, F-16 and F-18, with target destruction at distances from 200 m (660 ft) to 32 n miles (60 km; 37

miles), and with effective air-to-surface capability. All-swept mid-wing configuration, with wide ogival wing leading-edge root extensions (LERX), 40 per cent of lift provided by lift-generating centre-fuselage, twin tailfins carried on booms outboard of widely spaced engines with wedge intakes. Gap between roof of each intake and skin of wingroot extension for boundary layer bleed.

Fire-control and mission computers link radar with laser range-finder and infra-red search/track sensor, in conjunction with helmet-mounted target designator. Difficult to get into stable flat spin, reluctant to enter normal spin, recovers as soon as controls released; wing leading-edge sweepback 73° 30' on LERX, 42° on outer panels; anhedral approximately 3°. Tailfins canted outward 6°; leading-edge sweep 47° 50' on fins, 50° on horizontal surfaces; anhedral 3° 30'. Fins canted outwards 6°. Engine replacement time 2 hours; preflight preparation 20 minutes. Design flying life 2,500 hours.

FLYING CONTROLS: Digital fly-by-wire.

STRUCTURE: Approximately 7 per cent of airframe, by weight, of composites; remainder metal; three-spar wings with three 'false spars' two ahead of, one behind, torsion box; 16 stringers and skins reinforced by stringers; trailing-edge wing flaps, ailerons and vertical tail surfaces of carbon fibre honeycomb; approximately 65 per cent of horizontal tail surfaces aluminium alloy, remainder carbon fibre; semi-monocoque all-metal fuselage built around 10 mainframes in three subassemblies, with forward (frames 1 to 3), centre (frames 4 to 7) and rear sections, the latter including the engine bays; fuselage sharply tapered and downswept aft of flat-sided cockpit area, with ogival dielectric nosecone mounting PVD-18 main pitot boom (PVD-7 auxiliary pitot mounted on side of nose); small vortex generator each side of nose helps to overcome early tendency to aileron reversal at angles of attack above 25°; tail surfaces carried on slim booms alongside engine nacelles.

LANDING GEAR: Hydromash retractable tricycle type, with oleo-pneumatic shock-absorbers. Mainwheels retract forward into wingroots, turning through 90° to lie flat above leg; nosewheels, on trailing-link oleo, retract rearward between engine air intakes. Hydraulic retraction and extension, with mechanical emergency release.

POWER PLANT: Two Klimov/Sarkisov RD-33MK Morskaya Osa (Sea Wasp) 'marinised' turbofans, each 85.3 kN (19,180 lb st) with afterburning. Engines mounted 4° nose-up, and nacelles toe-in by 1° 30'. Engine ducts canted at approximately 9°, with wedge intakes, sweepback at approximately 35°, under wingroot leading-edge extensions. Refuelling probe and increased internal capacity.

ACCOMMODATION: Pressurised cockpit enclosed by frames 1 and 2. Pilot only, on 16° rearward-inclined K-36DM Series 2 zero/zero ejection seat, giving -14° view forward over the nose, and under hydraulically actuated, rearward-hinged transparent blister canopy in high-set cockpit. Sharply inclined one-piece curved windscreen of electrically de-iced triple glass. Three internal mirrors provide rearward view.

SYSTEMS: Two independent hydraulic systems powered by NP-103A variable-displacement pumps, driven by the engine accessory gearboxes, pressurised to 207 bar (3,000 lb/sq in), with 80 litres (21 US gallons; 17.5 Imp gallons) fluid. Main system powers one chamber of each control surface actuator, leading-edge and trailing-edge flaps, stick-pusher, artificial feel unit, landing gear extension/retraction, nosewheel steering and APU exhaust door; back-up system powers second chamber of each control surface actuator and stick-pusher, and can be powered by an emergency NS-58 pump.

Three separate pneumatic systems, with main system powering the wheel-brakes, canopy, fuel shut-offs and brake parachute actuator and jettison; and emergency system operating mainwheel brakes, and allowing emergency gear extension; final system pressurises hydraulic tanks and avionics bays.

Air conditioning uses bleed air cooled by heat exchangers and turbocooler. System also pressurises pilot's suit, demists screen and cools the gun bay.

Ozh-65 glycol-based liquid cooling system for radar.

AVIONICS: Expected to incorporate French, Russian and Indian components integrated by Elektroavtomatika or RPKB.

Radar: Phazotron-NIIR Zhuk-M (Zhuk-MEh in export form for MiG-29K and -29SMT).

N011M Bars offered as basis for alternative.

Mission: Helmet-mounted sight.

ARMAMENT: R-73 (AA-11 'Archer'), R-27 (AA-10A 'Alamo'), and/or R-77 (AA-12 'Adder') AAMs; Kh-35 (AS-20 'Kayak'), Kh-31 (AS-17 'Krypton') and Kh-29 (AS-14 'Kedge') ASMs; KAB-250KR TV-guided bombs; FAB-500 and FAB-250 free-fall bombs; and rocket pods. One 30 mm Gryazev/Shipunov GSh-301 (TKB-687/9A4071K) single barrel gun in port wingroot leading-edge extension, with 150 AO-18 rounds.

DIMENSIONS, EXTERNAL:
Wing span 11.99 m (39 ft 4 in)
Wing aspect ratio 3.4
Length overall: incl noseprobe 17.37 m (56 ft 11¼ in)
folded 14.13 m (46 ft 4¼ in)
Height overall 5.18 m (17 ft 0 in)

AREAS:
Wings, gross 42.00 m² (452.1 sq ft)

WEIGHTS AND LOADINGS:
Max weapon load 4,500 kg (9,921 lb)
Max fuel load 5,240 kg (11,552 lb)
T-O weight: normal 18,550 kg (40,895 lb)
max 22,400 kg (49,383 lb)
Max wing loading 533.3 kg/m² (109.24 lb/sq ft)
Max power loading 131 kg/kN (1.29 lb/lb st)

PERFORMANCE:
Max level speed:
at height 1,296 kt (2,400 km/h; 1,491 mph)
at S/L 670 kt (1,240 km/h; 771 mph)
Max rate of climb at S/L 17,760 m (58,260 ft)/min
Service ceiling 17,500 m (57,420 ft)
Range:
combat: with max internal fuel 459 n miles (850 km; 528 miles)
with external tanks 702 n miles (1,300 km; 807 miles)
ferry 1,889 n miles (3,500 km; 2,174 miles)
g limits +8

MiG-AT

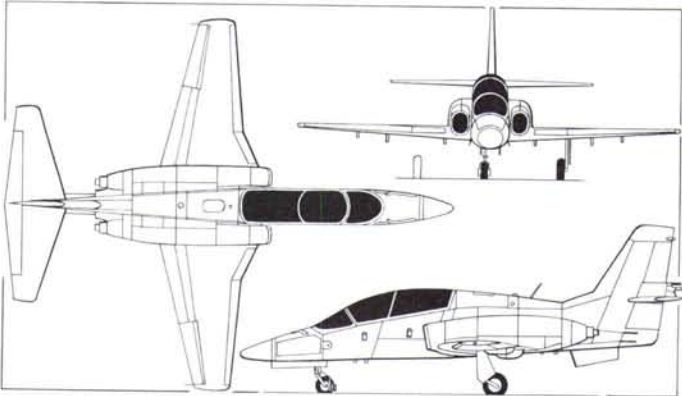
TYPE: Advanced jet trainer/light attack jet.
PROGRAMME:

DEVELOPMENT MILESTONES

Design began	late '80s
Programme launched	25 Jun 90
Official go-ahead	May 92
Rolled out	18 May 95
First flight	16 Mar 96
Official first flight	21 Mar 96

Design started late 1980s; start of work formally authorised on 25 June 1990 by State Commission for Military-Industrial Affairs, in parallel with contracts to competing design bureaux; selected in May 1992 as one of two finalists (with Yak-130, following rejection of single-engined Sukhoi S-54 and Myasishchev M-200 contenders) as replacements for Aero L-29 Delfin and L-39 Albatros; originally planned (as MiG-ATTA, a designation also applied to abortive joint venture with Promavia) with T tail and R-35 (DV-2) engines, with wing by Daewoo, landing gear by Messier-Bugatti, avionics by Sextant, Thomson-CSF (now Thales) and SFENA. Under October 1992 and subsequent agreements, prototypes and pre-series aircraft are powered by Larzac 04R20 engines supplied by SNECMA of France; production aircraft for domestic market could have Larzac licence-built by Chernyshev of Moscow, though there is a new Russian engine - the 16.7 kN (3,748 lb st) Aviadvigatel (Soyuz/CIAM) RD-1700 - which is stated to be 2.5 times cheaper than the Larzac and which may remedy early shortfalls in performance, ceiling and range. Suggested that MiG-AT has bureau Type number 08, perhaps with original T-tail configuration being 8.1 and later version as 8.2, prototype configuration being 8.21.

Prototype rolled out 18 May 1995; high-speed taxi trials at Zhukovsky August 1995; first 5 minute hop 16 March 1996; first flight 21 March 1996, piloted by Roman Taskaev; three aircraft to be used for flight test programme; two static test airframes; by 27 March 2001, first prototype had flown 496 sorties and second, 47. This increased by April 2002 to combined total of 770. Russian Air Forces began acceptance trials in December 2002 at 929th Test Centre, Akhtubinsk. Production of first series of 16 at RSK 'MiG' (Voronin) plant well advanced with seven in final assembly by December 1998. Subsequent progress delayed by funding difficulties; total of six airframes (including static test) completed by



MiG-AT advanced trainer (James Goulding)

1129404

late 2001, although only two then flown. Fourth flying aircraft handed over to MiG (for completion) by mid-2001. However, by end of 2003 only two aircraft flown, but third then expected to fly in early 2004, with fourth following six months later. Neither third nor fourth aircraft appeared during 2004, however.

Following initial series of static trials on second (non-flying) airframe, operation at 5,600 kg (12,346 lb) cleared in 2001; subsequent increases planned to 6,500 kg (14,330 lb), then 7,800 kg (17,196 lb). By 2003, second prototype had received full-standard digital FBW system and cockpit displays, including 152 × 203 mm (6 × 8 in) LCD MFD.

Russian requirement for 200 to 250 trainers in this category. Request for funds for first 10 aircraft made by Russian Air Forces, late 1996, at which time 10 engines ordered from Turbomeca-SNECMA (following initial five supplied for two prototypes). Further 20 engines ordered late 1997 for FFr230 million (US\$39 million), while Sextant contracted to supply 30 nav/attack systems. Competition against Yak-130 continued throughout 1990s; Russian Defence Ministry committee responsible for deciding between two contenders held first meeting on 17 February 2002, having been constituted six days earlier; Yak announced (formally, on 10 April 2002) as winner, but MiG encouraged to continue development of AT for possible export. However, in February 2003, Russian Air Forces C-in-C declared MiG-AT still in contention for production contract.

Actively promoted in India (evaluated in Russia by IAF pilots, December 2001) and South Africa; eliminated from Indian and South African competitions by BAE Hawk. Greek requirement for 40 trainers was targeted in 2001. Also assessed by Algeria and UAE. MiG-AT aircraft now being marketed as one element in AT System, incorporating simulators, computerised class rooms, part-task simulators, and video training packages, all using unified software. In August 2003, RSK 'MiG' and PZL signed enabling agreement for MiG-AT licensed production in Poland to replace TS-11 Iskra.

CURRENT VERSIONS (general): **MiG-AT**: Basic trainer; suitable for combat use of unguided weapons against ground and sea targets, and air-to-air missiles in conjunction with helmet-mounted target designation system. Pylons for three weapons/stores in trainer role, seven for combat training. Version for domestic use (ATR) has Russian-built engines and avionics; export version (ATF) has Sextant Topflight avionics (French).

Production version has longer nose than prototypes, but with pitots repositioned to slightly ahead of windscreen.

MiG-UTS: (MiG-ATR) Planned Russian Air Forces' version, with Russian avionics and RD-1700 engines.

MiG-ATS: Combat trainer, with increased capabilities and underwing hardpoints able to launch guided missiles, using guidance equipment pod. Second flying prototype (823 '83') to this standard and has Russian avionics.

MiG-AS: Single-seat light tactical fighter version with built-in gun and radar for all-weather use of AAMs and ASMs; intended to compete in international market with BAE Hawk 200. Single-seater, aerodynamically similar to original MiG-AT, with rear cockpit covered by metal fairing of similar outline to original canopy.

MiG-AP: Patrol coastguard fishery protection law enforcement and SAR co-ordination aircraft; based on MiG-AS; nose-mounted search radar.



MiG-AT advanced trainer prototype (Yefim Gordon)

1159321

All versions can be modified for deck operation on aircraft carriers at customer's request as **MiG-ATK** (French avionics), **MiG-ATSK** (armed trainer), or **MiG-ASK** (single seater). Span with optional wing folding 6.50 m (21 ft 4 in). Provision for deck arrester hook and catapult launching.

MiG-AT can undertake the following training missions, all with take-off at 50 per cent fuel (plus 150 kg; 331 lb reserves):

Basic flying training: Between 30 and 35 flight manoeuvres, three roller landings and straight-in final landing at up to 27 n miles (50 km; 31 miles) from base, altitude up to 6,000 m (19,680 ft).

Ground attack: Four diving attacks, three advanced manoeuvre attacks and circuit/landing against visual target up to 43 n miles (80 km; 50 miles) from base, transiting at up to 2,500 m (8,200 ft).

Interception/combat manoeuvring: Loiter, directed interception, attack and close combat, day VMC/IMC at up to 140 n miles (260 km; 161 miles) from base, altitudes up to 8,000 m (26,240 ft).

CURRENT VERSIONS (specific): **AT-1/821 '81':** Prototype; first flight 16 March 1996; first 'official' flight 21 March 1996. Has been modified since its initial flights, briefly gaining in overwing fence level with the leading-edge discontinuity. This since removed, but intakes have been redesigned and now project forward of the wing leading-edge; now have oval cross-section and blunter lips, rather than appearing to be sharp, inverted Us from the front. New intake configuration is understood to have first flown during May 1999; shown at MAKs '99, Moscow, August 1999. Generally French instruments in front cockpit; rear cockpit now filled with test instrumentation. Tested with external fuel tanks. Conventional (non-FBW) controls. By 2001 had replaced pitot booms with shorter units not protruding beyond nosecone. Modified in 2004 with twin ventral fins.

AT-3/823 '83': Second flying prototype shown (then still unflown) at MAKs '97, Moscow, August 1997; nominally representative of intended UTS in some respects, and of ATS armed trainer configuration in others. Fitted with centreline and underwing hardpoints; weapon carriage trials; Russian avionics and displays. Fitted with three-channel, digital FBW system in early 2000 (first Russian aircraft thus equipped); original 70 kg (154 lb) nose counterweight then removed, giving neutral stability. Original intake configuration with overwing fences was replaced by current design and aircraft resumed flying (with desert camouflage scheme) in June 2001, appearing at Paris later that month and first displaying wingtip missile rails.

AT-4/824 '84': Third flying prototype; under construction by 1999, but not flown up to mid-2006. Was to have featured new Sextant avionics suite (full Topflight system, including compatibility with helmet-mounted displays); completion deferred pending availability of RD-1700 engines. By 2006 was envisaged as representative of Russian Air Forces version, with RD-1700 engines and avionics by Elektroavtomatika.

COSTS: USD10 million to USD12 million (2002); development cost USD200 million.

DESIGN FEATURES: Intended to have manoeuvrability comparable with front-line combat aircraft, and service life of 15,000 flying hours or 30 years, with not fewer than 25,000 landings, maximum angle of attack of 25°, and sustained 5.4 g turn in 4 km (2.5 mile) radius at M0.7. Able to fly OEI at any stage, including take-off. Reconfigurable FBW FCS to simulate both the handling and limits of other front-line combat types. Onboard simulation of manoeuvring target, meteorological conditions and system failures via HUD, as well as specialised training for all operational modes of individual types of modern combat aircraft of Russian or foreign manufacture.

Conventional low-wing monoplane; wing-root leading-edges swept forward, with engine air intakes initially overwing to minimise risk of FOD; sweptback vertical tail surfaces; unswept tailplane; tailcone comprises two front-hinged door-type airbrakes.

FLYING CONTROLS: Avionika KSU-821 integrated hybrid (digital/analogue) multichannel fly-by-wire flight control system with multiple redundant air data computer. System incorporates autopilot, autothrottle and automatic stall-protection systems. Three-axis controls; three leading-edge slat sections and single-section slotted trailing-edge flaps on each wing. (Second prototype also flown with leading-edge flaps, which may be adopted). Split two-section rudder above and below tailplane.

STRUCTURE: One-piece, three-panel tapered wing of aluminium alloy, with some honeycomb skin. Three-section fuselage of aluminium alloy, but reportedly with 40 per cent of skin in CFRP/GFRP, including access panels on spine, three-piece engine covers, nose avionics bay cover and parts of wing/nacelle and nacelle/fuselage fairings. CFRP intake ducts and CFRP honeycomb wing trailing-edge control surfaces (elevators and flaps) and fin box, rudders, tailplane and elevators. Fin leading-edge of aluminium alloy and integral with rear fuselage. Titanium alloy rear fuselage forming 'open-box' with sidewalls acting as engine bay fire protection. Split airbrakes and ejection seat mounting tracks also of titanium with intake lips in stainless steel.

LANDING GEAR: Retractable tricycle type; nosewheel offset to starboard; single wheel on each trailing-link unit; wide-track main units retract inward, nosewheel forward; mainwheel tyre size 660x200, pressure 8.80 bar (128 lb/sq in); nosewheel tyre size 500x150, pressure 4.90 bar (71 lb/sq in); high-efficiency brakes; operation practicable from unpaved surfaces of bearing ratio 6 kg/cm² (85.3 lb/sq in).

POWER PLANT: Two Turbomeca-SNECMA Larzac 04-R20 turbosfans, each 14.12 kN (3,175 lb st), mounted above wingroots. MRT-931 FADEC controls. Ratings can be reduced by 30 to 40 per cent for primary training. Export version offered with Larzac 04-Y3, having thrust increased to 16.7 kN (3,748 lb st) in joint development venture between Turbomeca and Klimov. Change to 16.7 kN (3,748 lb st) Chernyshev-built Soyuz RD-1700 originally planned by 2002, but had not flown by mid-2006. One main fuselage fuel tank and one (three-section) tank in each inner wing. Total capacity 2,390 litres (632 US gallons, 527 Imp gallons). Single-point pressure refuelling point in lower rear fuselage adjacent to wing trailing-edge, with five gravity refuelling points (one above the fuselage tank and two above each wing). Tanks pressurised with engine bleed air to ensure high-altitude supply.

ACCOMMODATION: Two crew in tandem, on Zvezda K-93-LT zero/zero, 60 m (200 ft) inverted flight ejection seats operable at up to 485 kt (900 km/h; 559 mph) and M1.5 at altitudes up to 15,000 m (49,125 ft); minimum inverted flight ejection height 50 m (165 ft). Rear seat raised by 400 mm (15.75 in) to improve occupant's forward view. View over the nose -17° from cockpit, -7° from the rear. One-piece birdproof canopy, hinged on starboard side, with 'lock the canopy' warning. Provision for blinds for IFR flight training. Some sources suggest provision of 'built-in ladders', but no evidence for any more than retractable steps.

SYSTEMS: Dual hydraulic systems, driven by independent Messier-Bugatti PR70660-20 engine-driven pumps, actuate control surfaces, landing gear and wheel doors. General system supplied by starboard engine actuates one chamber of each electrohydraulic control actuator and hydraulic actuators of other systems; booster system supplied by port engine actuates other chamber of control actuators. Auxiliary booster system operated by NS-65 emergency hand pump. Electrical system supplies primary 27 V DC and 200/115 V 400 Hz three-phase secondary AC. Two 9 kW Auxilec 8044-31 DC starter/generators with Auxilec WDII-014 control and protection unit; two AC static inverters; 15CTSS-45B lead-zinc batteries.

AVIONICS: Integrated by Russian GoSNIIAS avionics research institute and Sextant Avionique, France. Multifunctional central computer, with all data integrated through MIL-STD-1553B equivalent databus.

Comms: ERA 2000 VHF/UHF transceiver, SG100 IFF, SPU-821 intercom, ALMAZ-UBS voice recorder.

Radar: Osa installation under development for optional fitment.

Flight: Automatic control system; UMT 33 air data unit; Totem 3000 laser-gyro INS; NSS 100S-1 GPS, NR 510A 101 VOR/ILS receiver/marker; NC-12B Tacan; EVS 915 video recorder; Tester U3A flight data recorder.

Instrumentation: Two MFD 55 multifunctional liquid-crystal colour CRT displays with buttons in each cockpit; helmet-mounted displays; front-cockpit wide-field HUD with input from colour video and TV camera; HSI/ADI.

ARMAMENT (MiG-AS): Nine (including wingtips) hardpoints for up to 2,000 kg (4,410 lb) of guided and unguided missiles, guns and bombs, including R-73E (AA-11 'Archer'), R-77 (AA-12 'Adder'), AIM-9L Sidewinder or Magic AAMs; Kh-29TD (AS-14 'Kedge') or Kh-31AE/PE (AS-17 'Krypton') ASMs; UB-16 (16 x 57 mm) or UB-8M (20 x 80 mm) rocket pods; cluster weapons; 100 to 500 kg bombs; UPK-23 twin-barrel 23 mm gun pods; eight Vikhr anti-tank missiles.

DIMENSIONS, EXTERNAL:	
Wing span	10.16 m (33 ft 4 in)
Wing aspect ratio	5.7
Length overall	12.01 m (39 ft 4 3/4 in)
Height overall	4.42 m (14 ft 6 in)
Wheel track	3.80 m (12 ft 5 3/4 in)
Wheelbase	4.43 m (14 ft 6 1/2 in)

AREAS:	
Wings, gross	17.67 m ² (190.2 sq ft)

WEIGHTS AND LOADINGS:	
Fuel: nominal	850 kg (1,874 lb)
intermediate	1,280 kg (2,822 lb)
max	1,680 kg (3,704 lb)
Normal T-O weight: training	4,610 kg (10,163 lb)
Max T-O weight: training	5,210 kg (11,486 lb)
combat	7,800 kg (17,196 lb)
combat(alternate)	8,150 kg (17,967 lb)
Max wing loading:	
Normal T-O	260.9 kg/m ² (53.43 lb/sq ft)
Max T-O	396.2 kg/m ² (81.14 lb/sq ft)
Max power loading:	
Normal T-O	163 kg/kN (1.60 lb/lb st)
Max T-O	248 kg/kN (2.43 lb/lb st)

PERFORMANCE (estimated; A: basic training, B: advanced training):

Max Mach No.: A, B	0.85
Max level speed:	
A, B:	
at 2,500 m (8,200 ft)	540 kt (1,000 km/h; 621 mph)
at S/L	460 kt (850 km/h; 528 mph)
T-O speed: A	97 kt (180 km/h; 112 mph)
B	97-119 kt (180-220 km/h; 112-137 mph)
Landing speed:	
A, B	94-125 kt (175-232 km/h; 109-144 mph)
Max rate of climb:	
at S/L: A	1,680 m (5,510 ft)/min
B	4,140 m (13,580 ft)/min
at 5,000 m (16,400 ft): A	1,320 m (4,330 ft)/min
B	2,400 m (7,875 ft)/min
Service ceiling: A, B	14,000 m (45,940 ft)
T-O run: A	540 m (1,772 ft)
B	310 m (1,020 ft)
Landing run:	
on concrete: B	570 m (1,870 ft)
on unpaved runway: B	540 m (1,775 ft)
Range at M0.5 at 6,000 m (19,680 ft):	
A, B	647 n miles (1,200 km; 745 miles)
Ferry range: A, B	1,400 n miles (2,600 km; 1,615 miles)
A, B (alternate)	1,079 n miles (2,000 km; 1,242 miles)
g limits: A, B	+8.0/-2.0
Sustained g limit at M0.7 in turn:	
at S/L: A	+4.5
B	+8
at 5,000 m (16,400 ft): A	+3.4
B	+5
Max side wind for T-O/landing	29 kt (54 km/h; 33 mph)

MiG-201

TYPE: Light utility twin-prop transport.

PROGRAMME: First details announced in mid-2003. Construction of prototype then scheduled to begin in late 2004 or early 2005, but revealed in November 2005 that mockup commission would not be convened until 2006.

CURRENT VERSIONS: **MiG-201:** As described.

MiG-201M: Alternative power plant of two 324 kW (435 hp) Teledyne Continental GTSIO-520F flat-six piston engines.

MiG-201MT1: Turboprop version with two 560 kW (751 shp) Walter M 601Es.

MiG-201MT2: Alternative turboprop version with two Pratt & Whitney Canada PT6A-42s, each rated at up to 634 kW (850 shp). Range 755 n miles (1,400 km; 869 miles) with max payload.

COSTS: USD650,000 with M-9 engines; USD1,400,000 with PT6A-42 engines. Development cost estimated USD60 million to 70 million (2005).

DESIGN FEATURES: Replacement for Antonov An-2 utility biplane, but with twin engines. Rugged construction and short-field performance with maximum of 10 occupants or equivalent freight.

High, constant-chord wing; moderately sweptback fin with ventral fillet; low-mounted, constant-chord tailplane. Service life 40,000 hours.

STRUCTURE: Generally of metal.

LANDING GEAR: Tricycle type; retractable.

POWER PLANT: Two 327 kW (434 hp) VOKBM M-9FS nine-cylinder radial engines, each driving an MT-Propeller MTV-9 three-blade, variable-pitch propeller. Version powered by liquid natural gas may be offered.

ACCOMMODATION: Provision for nine passengers.

DIMENSIONS, EXTERNAL:	
Freight door (port): Height	1.22 m (3 ft 1 1/4 in)
Width	1.30 m (4 ft 3 3/4 in)

DIMENSIONS, INTERNAL:

Cabin: Length	4.50 m (14 ft 9 in)
Max width	1.52 m (4 ft 11 3/4 in)
Max height	1.35 m (4 ft 5 1/4 in)

WEIGHTS AND LOADINGS:

Weight empty, equipped	2,850 kg (6,283 lb)
Max payload	840 kg (1,852 lb)
Max fuel weight	650 kg (1,433 lb)
Max T-O weight	3,900 kg (8,598 lb)

PERFORMANCE:

Max level speed	205 kt (380 km/h 236 mph)
Econ cruising speed	162 kt (300 km/h; 186 mph)
Service ceiling	6,000 m (19,680 ft)
T-O run	390 m (1,280 ft)
Range: with 840 kg (1,852 lb) payload	297 n miles (550 km; 341 miles)
with 550 kg (1,213 lb) payload	1,025 n miles (1,900 km; 1,180 miles)

MIL

MOSKOVSKY VERTOLETNY ZAVOD IMIENI M L MILYA OAO
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DESIGNER GENERAL (ACTING): Aleksei Samusenko

OKB founded 1947 by Mikhail Leontyevich Mil, who was involved with Soviet gyroplane and helicopter development from 1929 until his death on 31 January 1970, aged 60. His original Mi-1, first flown September 1948 and introduced into service 1951, was first series production helicopter built in former USSR. Twelve basic types of Mil helicopter have been built in 100 subvariants, representing total production of some 30,000, of which over 4,500 exported to 80 countries; 95 per cent of all helicopters in Russian Federation and Associated States (CIS) are Mil designs. Mil helicopters have set 96 world records. The Mil design bureau (previously OKB 4, then OKB 329 from 1951) has its own experimental workshops in Moscow and flight test facilities at Chkalovsky airfield. The company established a joint venture, EuroMil, with Eurocopter and others, for development and production of the Mil Mi-38, but Eurocopter withdrew in 2003. The Mi-38 flew at Kazan in December 2003; promotion and marketing is largely the responsibility of the Kazan company.

In 2001, Mil designers reported to be working on seven projects, comprising Mi-30, Mi-32, Mi-54 and Mi-58 transports; and Mi-40, Mi-42 and Mi-44 combat helicopters. Of these, only details of the Mi-40, Mi-54 and Mi-58 have been released and only the Mi-54 is currently listed as an active programme, along with Mi-28 and Mi-38. Continues to provide support and offer upgrades for Mi-2, Mi-8/Mi-17, Mi-24/Mi-35 and Mi-26, including Mi-24 turbine conversion launched in 2003.

Mil forced into receivership in 1999; new management, imposed by Federal Financial Recovery Service, returned company to solvency and paid staff wage arrears; bankruptcy cancelled 23 February 2001 after effective return to State control when debts bought-out by Gosincor (Ministry of Property) and Inter-Regional Bank.

Mil design and production facilities eventually to be integrated into group managed by Oboronprom, and including Kamov, Kazan Helicopters, Rostvertol and Ulan-Ude. Oboronprom assumed government's shareholding in Mil in May 2005 and later bought privately owned shares. The lighter types of Mil helicopter were marketed by the separate entity, LVM, but this appears not to have been active recently.

MIL Mi-17 (Mi-8M), Mi-19, Mi-171 and Mi-172

NATO reporting name: Hip

TYPE: Multirole medium helicopter,

PROGRAMME:

DEVELOPMENT MILESTONES

Mi-8	
First flight	24 Jun 61
Subsequent versions	
Mi-17	
First flight	17 Aug 75
Public debut	Jun 81
First delivery	1977

Development of original Mi-8 began May 1960, to replace piston-engined Mi-4; first of two prototypes (V-8), with single AI-24V turboshaft and four-blade main rotor, flew 24 June 1961, given NATO reporting name 'Hip-A'; further prototype (V-8A; 'Hip-B'), with two production standard TV2-117 engines and four-blade main rotor, flew 2 August 1962; change to five-blade rotor for production. Total 7,300 Mi-8s and subsequent improved Mi-17s and Mi-171/172s marketed and delivered from Kazan since 1967, with more than 11,000 (about 3,700 Mi-8T and 7,300 Mi-17) from Ulan-Ude since 1970 for civil and military use, including 3,500 exported to 70 countries.

Prototype Mi-17, known initially as Mi-18, completed 1975 with basic Mi-8 airframe, and power plant and dynamic components of Mi-14. First flew 17 August 1975. Entered service with former Soviet forces in 1977 as Mi-8MT. First displayed at 1981 Paris Air Show as Mi-17 for civil use and export; exports began (to Cuba) 1983; Mi-8MTV followed in 1987; production of improved versions continues at Kazan and Ulan-Ude plants, Kazan has undertaken further development of the Mi-17 and these variants are described separately.

CURRENT VERSIONS: Mi-17: ('Hip-H') Basic designation of series, with suffix M for military versions. Mi-17P is basic civil version with 28 seats and rectangular cabin windows.

Detailed description applies to basic versions, except where indicated. Note that all helicopters of Mi-8/Mi-17 series in Russian military service are known as Mi-8s of various subtypes, regardless of engines fitted.

Mi-8MT: ('Hip-H') Designation of standard Mi-17s in RFAS military service. Twin or triple stores racks, but normal armament is 40 × 80 mm S-8 rockets in two BV-8-20A packs. Afghan experience led to adoption of nose armour, IR jammer, IR suppressors and provision for door-mounted PKT machine gun (rear starboard) and AGS-17 Plamya grenade launcher or NSV 12.7 mm Utyos heavy machine gun (forward port cabin door).

Mi-8MT EW variants: More than 30 EW versions of the Mi-8MT serve, or have served, with RFAS armed forces.

Mi-8MTPB: (or Mi-17TPB, Mi-17P, Mi-17PP) ('Hip-H EW') ECM (radar and communications jammer) and comint helicopter, with three jamming systems in D/F band range over 30° sector and other frequencies over 120°.

Mi-8MTV: ('Hip-H') (V = *visotnyi*: high-altitude); 1,633 kW (2,190 shp) TV3-117VM turboshafts for improved 'hot-and-high' operation. Built at Ulan-Ude (as **Mi-8AMT**) from 1991; 100 built by 1999. Civil version built at Kazan is **Mi-8MTV-1**; missile-armed, radar-equipped military version with six-hardpoint stub-wing is **Mi-8MTV-2**; export equivalent is **Mi-17-1V**, with optional armament, nose radar, flotation gear and firefighting equipment. Indian Mi-17-1V has enlarged side doors and a rear ramp to facilitate airdrops, as developed at Kazan (which see). Firefighting conversion by Airod in Malaysia adds detachable aluminium boom to starboard side, stowed facing forwards, but trainable through 90°, with hose nozzle at tip. Internal tanks, fillable via own trailing hose and onboard pump in 1½ minutes, carry 2,300 litres (608 US gallons; 506 Imp gallons) of water, which may also be dumped from belly port in 8 seconds. Addition of suffix **-GA** indicates civil version, often with rectangular 'Salon'-type cabin windows. **Mi-8MTV-1S** is VVIP variant for Rossiya state transport company; two believed ordered in 2001. An Mi-8MTV upgrade project was under way in mid-2002 that may result in adoption of more powerful VK-2500 engines, composites main rotor blades and updated avionics as well as new armament to be developed by 2010; this is expected to be offered in new-build form towards the end of the present decade.

Mi-8MTKO: (or Mi-8N); ('Hip-H') (O = *ochki nochnogo videniya*: night vision goggles). Dedicated night attack conversion of Mi-8MT/MTV to meet urgent operational requirement: tested in Chechnya ('Caucasian campaign') with aircraft equipping BEG (Boyevaya Eksperimentalnaya Gruppy: Combat Experimental Group) based at Mozdok; at least five aircraft thus upgraded by mid-2000. (Unit additionally equipped with four or six upgraded Mi-24s, and also parented trial deployment of Ka-50. Originally intended to be equipped with modified Ka-29TB and Ka-50). Upgrade produced by Mil Moscow plant, with collaboration of Russkaya Avionika, NPO Geofizika and Uralskiy Optik Mechanicheskiy Zavod team, and tested at Russian Air Forces flight test centre at Chkalovskaya from April 1999, thereafter undergoing evaluation at Torzhok with the 696th IVP, equipping BEG from September 1999. By 2003, first deliveries had been made to unit in North Caucasus district, with further deliveries planned (in conjunction with Mi-24PN 'Hinds') to equip one night-capable regiment by year's end. Original requirement was for total of 40, with deliveries suspended on termination of Chechen campaign, only to resume in early 2004.

Aircraft has NVG-compatible cockpit and external lights and may also feature NVG-covert, formation-keeping external lights. Crew equipped with Geofizika ONV-1 NVGs, and also use gyro-stabilised GOES-321M undernose turret containing AGEMA 1000 or SAGEM-321 FLIR, laser range-finder and LLTV. Incorporates cockpit and navigation system upgrade, with KNI-8 navigation and display system, MFI-68 (or, possibly, US-supplied) colour LCD MFDs, A737-00 GPS, full-standard MTO will gain new air data system and Saratov Industrial Automatics OKB PKV-M digital autopilot. Real-time targeting/tactical information datalink also installed. Similar export version offered to India (which has already used its existing Mi-17s in the gunship role in Kashmir, and hopes to upgrade these with an Mi-35-type weapon aiming system, improved avionics and a 'night cockpit') and others as **Mi-17N**.

Mi-17-1VA: Version of Mi-8MTV-1 produced for Ministry of Health of former USSR as flying hospital.

Mi-8MTV-3/Mi-172A: As Mi-8MTV-2, also from Kazan, but with four-hardpoint stub-wing and other equipment changes and planned for certification to FAR Pt 29 standards: TV3-117VM Srs 2 engines, giving maximum cruising speed of 118 kt (218 km/h; 135 mph) and service ceiling of 6,000 m (19,680 ft); air conditioning and heating systems, main and tail rotor blade de-icing, canopy demisting and heating of engine air intakes standard; options include flotation gear, Doppler, weather radar, DME, GPS, VOR, ILS, transponder and VIP interiors for seven, nine and 11 passengers. Standard seating for up to 26 passengers.

Mi-172A export version first exhibited at 1994 Singapore Air Show; based on 'salon' (rectangular window) cabin. Seven ordered by Mescro, India, 1995; others to Vietnam.

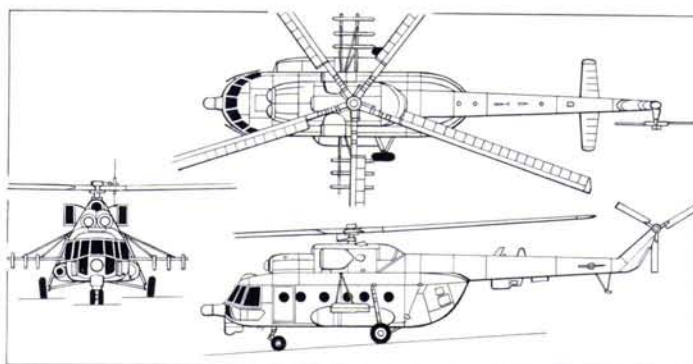
Mi-8MTV-7: Upgraded development by Kazan; announced 2002.

Mi-172AG: Announced mid-2000; proposed version with TV3-117SB3 engines, improved composites main rotor blades and upgraded navigation avionics.

Mi-17PI: As Mi-17P but single D-band jamming system able to jam up to eight sources simultaneously over 30° sector.

Mi-17PG: As Mi-17P but with H/I-band system for jamming pulse/CW and CW interrupted equipment.

Mi-17AMT: Provisional designation for proposed Ulan-Ude-built variant offered to Malaysia to meet eventual 40-aircraft requirement, with initial order for six CSAR-configured aircraft reportedly already placed. May have rear loading ramp of Mi-8MTV-5.



Mil Mi-8AMT(Sh) combat helicopter — the latest Mi-17 variant (James Goulding)



Ulan-Ude-built Mil Mi-171Sh (Yefim Gordon)

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Mi-17 will replace 31 S-61 Nuri helicopters, and two already in use with Malaysian Fire Department. SME Aerospace appointed as partner responsible for assembly, flight test and local certification.

Mi-8AMT(Sh) 'Terminator': Current counterpart of Mi-8MTV series, built at Ulan-Ude. Crew positions protected by armour plating. Armament can include up to eight Igla-V AAMs or 9M114/9M114M Shurm-V ('Spiral') ASMs, with thimble radome on nose and chin-mounted electro-optics pod; alternative armament configurations include up to four pods of B8V20A type, each containing 20 S-8 unguided rockets; or a mix of guided and unguided weapons. Prototype (RA-25755) exhibited at Farnborough in September 1996. First production helicopter almost complete by late 1998, but delayed by funding shortage. State testing began 10 April 2000, and had been completed by January 2001; funding assistance provided by Interprofavia. Offered for export as **Mi-171Sh**. Night-capable variant under development by mid-2001. Delivery of 16 Mi-171Sh to Czech Republic began 9 June 2005, when first three airlifted to Pardubice on An-124; following assembly and test flight, first example (9781) accepted by Air Force at Prerov on 26 June. Incorporates hydraulically actuated rear ramp and has large sliding door to starboard, plus rescue winch, integrated NVG compatibility and can be fitted with removable wings on upper mid-fuselage for carriage of up to four auxiliary fuel tanks, offering three times the endurance of basic Mi-17.

Mi-171: Export version of Mi-8AMT; first displayed 1989 Paris Air Show. Mostly Western avionics, including Honeywell and Rockwell Collins radios. Built at Ulan-Ude since 1991.

In August 2001, Ulan-Ude showed upgraded Mi-171A at Moscow Salon, featuring rear cargo ramp (straight-sided, compared with Kazan version) and enlarged starboard passenger door. Klimov VK-2500 turboshaft also installed on latest examples of Mi-171.

Mi-17V-5 (Mi-8MTV-5) and Mi-17V-7: Developed and built at Kazan. Described separately.

Mi-17KF Kittiwake: Flight deck upgrade offered by Kazan and Kelowna of Canada.

Mi-18: Original designation of prototype Mi-17.

Mi-19: Command relay platform; similar to earlier Mi-9.

Mi-17Z-2: Converted from 'Hip-H' in former Czechoslovakia for electronic warfare ECM role; local designation (Z-1 is similarly tasked Antonov An-26).

Long-range modification: AEFT (Auxiliary External Fuel Tanks) system by Aeroton adds a further 1,900 litres (502 US gallons; 418 Imp gallons) in two internal tanks, plus 2,850 litres (753 US gallons; 626 Imp gallons) in six tanks on the stores pylons of Mi-8MT, AMT, MTV-1, civil MTV and Mi-17 variants.

Upgrades: Kazan offers three stages of upgrade for existing Mi-17 variants. The first can include new composites main rotor blades with a 6,000-hour service life, NVG-compatible cockpit and improved avionics; second could include more powerful 1,864 kW (2,500 shp) engines, uprated transmission and Delta-H 'X-type' tail rotor, latter refinements presaging increase in MTOW to 14,000 kg (30,864 lb). Kazan has also teamed with BAE Systems and Kelowna Flightcraft Ltd to offer aircraft with new mission system, including automated flight control system and 'glass cockpit', plus FLIR, LLTV and other sensors; this upgrade package (or elements of it) can be installed in the Mi-172.



Mil Mi-8MTKO night attack version of 'Hip' (Yefim Gordon)

1153788



Mil Mi-8AMTSh, built at Ulan-Ude (Yefim Gordon)

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Kronshtadt is offering an avionics and cockpit upgrade, with LCD screens, digital moving map and embedded GPS.

Israel Aircraft Industries announced **Peak-17** in February 2001, combining features from Kamov Ka-50-2 Erdogan and Mi-35 export 'Hind' with 'glass cockpit', improved self-defence Rafael NT-D Dandy and NT-S Spike anti-armour missiles.

Elbit Systems of Israel in 2001 was promoting **'Andor'** Mi-8/17 upgrade for civil and military applications. Modular modernisation concept entails addition of various items of equipment, including electro-optical sensor turret, MFDs, HOCAS, NVGs, HUD, EW systems and choice of Eastern or Western weaponry.

CUSTOMERS: Many operational alongside Mi-8s in RFAS armed forces; also operated in Algeria, Angola, Armenia, Bangladesh, Bulgaria, Burkina Faso, Cambodia, China, Colombia, Costa Rica, Croatia, Cuba, Czech Republic, Ecuador, Egypt, Ethiopia, Hungary, India, Indonesia, Iran, Kenya, North Korea, Laos, Macedonia, Malaysia, Mexico, Myanmar, Nicaragua, Pakistan, Papua New Guinea, Peru, Poland, Romania, Sierra Leone, Slovak Republic, Sri Lanka, Syria, Turkey, Uganda, Ukraine, Venezuela, Vietnam, Yugoslavia. More than 810 exported by Aviaexport. Recent announced sales include 16 Mi-171s for Czech Republic (delivered in 2005) as part of Russian debt reduction effort and three Mi-171s for Bangladesh, these all from Ulan-Ude factory. Kazan factory delivered two Mi-17s to Vietnam and four Mi-17s to Indonesia in 2004, as well as first four of 20 Mi-17s to Kazakhstan, with balance to follow in 2005-06. Other recent orders include 13 Mi-17s for delivery to Venezuelan Army in first half of 2005 and one VIP-configured Mi-171 for Yemen that was due to be handed over in December 2004. Malaysia placed order for 10 Mi-171Shs from Ulan-Ude production in 2003 and could eventually obtain as many as 40 for the air force; initial deliveries planned for 2004 but deferred to 2005. Two additional Mi-171s handed over to Malaysian Ministry of Internal Affairs (for operation by police) in 2004. Croatia expected to receive up to 15 Mi-17s as debt reparations according to announcement in second quarter of 2005. Chinese orders began in 1990 with 24 Mi-17s, followed in 1995-97 by 60 Mi-171s; additional orders, including Mi-17V-5s, increased total to 190 by 2003, while further 24 Mi-17V-7s followed in 2003-2004.

COSTS: Kazan quoted USD3.7 million, flyaway, basically equipped, in March 2001. In mid-2002, Ulan-Ude quoting price as USD3.5 million to USD4 million, depending on configuration and equipment. Sale of 42 Mi-171s to Algeria in 2003 said to be worth USD180 million.

DESIGN FEATURES: Conventional pod and boom configuration; clamshell rear-loading freight doors on most versions, but both Kazan and Ulan-Ude plants offer rear-loading ramp version; five-blade main rotor, inclined forward 4° 30' from vertical; interchangeable blades of basic NACA 230 section, solidity 0.0777; spar failure warning system; drag and flapping hinges a few inches apart; blades carried on machined spider; pendulum vibration damper; three-blade port tail rotor; transmission comprises VR-14 two-stage planetary main reduction gearbox, intermediate and tail rotor gearboxes, main rotor brake, and drives off main gearbox for tail rotor, fan, AC generator, hydraulic pumps and tachometer generators; correct rotor speed maintained automatically by system that also synchronises output of the two engines; tail rotor pylon forms small vertical stabiliser; horizontal stabiliser near end of tailboom. Civil versions have rectangular cabin windows.

FLYING CONTROLS: Mechanical system, with irreversible hydraulic boosters; main rotor collective pitch control linked to throttles.

STRUCTURE: All-metal; main rotor blades, mainly VD-76 aluminium alloy, each has extruded spar carrying root fitting, 21 honeycomb-filled trailing-edge pockets and blade tip, with titanium abrasion shielding on some of leading-edge; balance tab on each blade; each tail rotor blade made of spar and honeycomb-filled trailing-edge; semi-monocoque fuselage. Composites blades and elastomeric hub components under development.

LANDING GEAR: Non-retractable tricycle type; steerable twin-wheel nose unit, locked in flight; single wheel on each main unit; oleo-pneumatic (gas) shock-absorbers. Mainwheel tyres 865x280; nosewheel tyres 595x185. Pneumatic brakes on mainwheels; pneumatic system can also recharge tyres in the field, using air stored in main landing gear struts. Optional mainwheel fairings.

POWER PLANT: Two 1,397 kW (1,874 shp) Klimov TV3-117MT turboshafts in basic Mi-17; should one engine stop, output of the other increases automatically to contingency rating of 1,637 kW (2,195 shp), enabling flight to continue. Alternative high-altitude TV3-117VM engine has installed ratings of 1,545 kW (2,071 shp) in emergency; 1,397 kW (1,874 shp) for T-O; 1,250 kW (1,677 shp) normal; and 1,103 kW (1,479 shp) for cruising. Newest version of engine is TV3-117VMA-SB3, which believed to be available for new-build and upgraded aircraft. Deflectors on engine air intakes prevent ingestion of sand, dust and foreign objects; engine cowling side panels form maintenance platforms when open, with access via hatch on flight deck. VK-2500 engine installed on latest versions of Mi-171.

Standard fuel capacity of 2,615 litres (691 US gallons, 575 Imp gallons), comprising 2,170 litres (573 US gallons; 477 Imp gallons) in main external tanks and 445 litres (118 US gallons; 98.0 Imp gallons) in feed tank. Additional 1,830 litres (483 US gallons; 402 Imp gallons) optional auxiliary fuel in two tanks.

ACCOMMODATION: Two pilots side by side on flight deck, with provision for flight engineer's station. Military versions can be fitted with external flight deck armour. Windscreen de-icing standard.

Seats and bulkheads of basic version quickly removable for cargo carrying. Standard military versions have cargo tiedown rings in floor, winch of 150 kg (330 lb) capacity and pulley block system to facilitate loading of heavy freight, an external cargo sling system (capacity 3,000 kg; 6,614 lb), and 24 tip-up seats along sidewalls of cabin; six additional centreline seats optional. Military Mi-17-1V carries up to 30 troops, up to 20 wounded or 12 stretchers in ambulance role, or weapons on six outrigger pylons; civilian Mi-17 promoted as essentially a cargo-carrying helicopter, with secondary passenger transport role. Mi-171/172 both able to carry up to 26 passengers. Large windows on each side of flight deck slide rearward. Sliding, jettisonable main passenger door at front of cabin on port side; electrically operated rescue hoist (capacity 150 kg; 330 lb) can be installed at this doorway. Rear of cabin made up of clamshell freight-loading doors, which are smaller on commercial versions, with downward-hinged passenger airstair door centrally at rear. Hook-on ramps used for vehicle loading.

SYSTEMS: (Mi-17-1V/171) AI-9V APU for pneumatic engine starting; AC electrical supply from two 40 kW three-phase 115/220 V 400 Hz GT40/P-48 V generators. Engine air intake de-icing standard. Provision for oxygen system for crew and, in ambulance version, for patients. Freon fire extinguishing system in power plant bays and service fuel tank compartments, actuated automatically or manually. Two portable fire extinguishers in cabin.

AVIONICS: (Mi-17-1V/171) *Comms:* Baklan-20 and Yadro-1G1 com radio.

Radar: Type 8A-813 weather radar optional.

Flight: Type A-723 long-range nav.

Instrumentation: ARK-15M radio compass, ARK-UD radio compass, DISS-32-90 Doppler; AGK-77 and AGR-74V automatic horizons; BKK-18 attitude monitor; ZPU-24 course selector; A-037 radio altimeter.

Self-defence: (optional) ASO-2V chaff/flare dispensers under tailboom and L-166V IR jammer (NATO 'Hot Brick') at forward end of tailboom.

EQUIPMENT: Options on military versions include external cockpit armour, triple-lobe engine nozzle IR suppressors and a VMR-2 fit for airdropping such stores as mines.

ARMAMENT: Various combinations of weaponry available, including 64 × 57 mm S-5 rockets in four UV-16-57 packs or 192 × 57 mm S-5 rockets in six UV-32-57 packs or four 9M17P Skorpion (AT-2 'Swatter') anti-armour missiles or six 9M14M Malyutka (AT-3 'Sagger') anti-armour missiles; can also operate with bombs and mines and able to use 23 mm GSh-23 gun packs, each with 250 rounds of ammunition. (AAMs and newer ASMs on Mi-8AMT(Sh).)

DIMENSIONS, EXTERNAL:

Main rotor diameter	21.29 m (69 ft 10½ in)
Tail rotor diameter	3.91 m (12 ft 9 ⅞ in)
Distance between rotor centres	12.66 m (41 ft 6 in)
Length: overall, rotors turning	
Mi-17	25.35 m (83 ft 2 in)



Mil Mi-171 in Chinese military service

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Fuselage: Mi-17	18.465 m (60 ft 7 in)
Nose to tail rotor c/l: Mi-17	18.425 m (60 ft 5½ in)
Mi-172	18.855 m (61 ft 10¼ in)
Mi-17MD	18.99 m (62 ft 3¾ in)
Fuselage, excl tail rotor	18.17 m (59 ft 7¼ in)
Width of fuselage, excl fuel tanks	2.50 m (8 ft 2½ in)
Tailplane span	3.705 m (12 ft 1¾ in)
Height: overall, rotors turning	5.545 m (18 ft 2¼ in)
to top of rotor head: Mi-8	4.73 m (15 ft 6¼ in)
Mi-17	4.745 m (15 ft 6¾ in)
Mi-17MD, Mi-171	4.755 m (15 ft 7¼ in)
Mi-172	4.865 m (15 ft 11½ in)
Wheel track: main	4.51 m (14 ft 9½ in)
Nose	0.30 m (11¾ in)
Wheelbase	4.28 m (14 ft 0½ in)
Fwd passenger door: Height	1.41 m (4 ft 7½ in)
Width	0.82 m (2 ft 8¼ in)
Rear passenger door: Height	1.70 m (5 ft 7 in)
Width	0.84 m (2 ft 9 in)
Rear cargo door: Height	1.82 m (5 ft 11½ in)
Width	2.34 m (7 ft 8¼ in)
DIMENSIONS, INTERNAL:	
Passenger cabin: Length	6.36 m (20 ft 10¼ in)
Width	2.34 m (7 ft 8¼ in)
Height	1.80 m (5 ft 10¾ in)
Cargo hold (freighter, excl doors):	
Length at floor	5.34 m (17 ft 6¼ in)
Width	2.29 m (7 ft 6¼ in)
Height	1.80 m (5 ft 10¾ in)
Volume	22.5 m ³ (795 cu ft)
AREAS:	
Main rotor disc	356.16 m ² (3,833.7 sq ft)
Tail rotor disc	12.01 m ² (129.28 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty, equipped: Mi-17	7,200 kg (15,873 lb)
Mi-171	6,913 kg (15,241 lb)
Mi-17-IV	7,489 kg (16,510 lb)
Mi-17-IVA/171	7,586 kg (16,724 lb)
Mi-8AMT(Sh)	8,493 kg (18,724 lb)
Fuel weight, Mi-17-IV/171:	
Normal	2,027 kg (4,469 lb)
Plus one auxiliary tank	2,737 kg (6,034 lb)
Plus two auxiliary tanks	3,447 kg (7,600 lb)
Max payload:	
Internal: Mi-17, Mi-17-IV/171, Mi-8AMT(Sh)	4,000 kg (8,820 lb)
External, on sling:	
Mi-17, Mi-17-IV	3,000 kg (6,614 lb)
Mi-171, Mi-8AMT(Sh)	4,000 kg (8,820 lb)
Mi-17-IV	5,000 kg (11,023 lb)
Normal T-O weight:	
Mi-17, Mi-17-IV/171, Mi-8AMT(Sh)	11,100 kg (24,470 lb)
Max T-O weight:	
Mi-17, Mi-8AMT(Sh)	13,000 kg (28,660 lb)
Mi-171	12,000 kg (26,455 lb)
Mi-172	11,878 kg (26,186 lb)
Max disc loading:	
Mi-17, Mi-17-IV/171	36.5 kg/m ² (7.48 lb/sq ft)
PERFORMANCE:	
Max level speed:	
Mi-17/172, max AUW	135 kt (250 km/h; 155 mph)
Mi-17-IV/171, normal AUW	135 kt (250 km/h; 155 mph)
Mi-17-IV/171, max AUW	124 kt (230 km/h; 143 mph)
Max cruising speed:	
Mi-17/172, max AUW	129 kt (240 km/h; 149 mph)
Mi-17-IV, normal AUW	135 kt (250 km/h; 155 mph)
Mi-171, normal AUW	124 kt (230 km/h; 143 mph)
Mi-171, max AUW	113 kt (210 km/h; 130 mph)
Service ceiling:	
Mi-17M, normal AUW	5,600 m (18,380 ft)
Mi-17M, max AUW	4,400 m (14,440 ft)
Mi-17-IV, normal AUW	6,000 m (19,680 ft)
Mi-17-IV, max AUW	4,800 m (15,740 ft)

Mi-171, normal AUW	5,700 m (18,700 ft)
Mi-171, max AUW	4,500 m (14,760 ft)
Mi-172, max AUW	5,650 m (18,535 ft)
Hovering ceiling OGE:	
Mi-17, max AUW	1,780 m (5,840 ft)
Mi-17M, normal AUW	3,900 m (12,795 ft)
Mi-17M, max AUW	1,500 m (4,920 ft)
Mi-17-IV/171, normal AUW	3,980 m (13,055 ft)
Mi-17-IV/171, max AUW	1,700 m (5,575 ft)
Mi-172, max AUW	3,300 m (10,825 ft)
Range with max standard fuel, 5% reserves:	
Mi-17, normal AUW	270 n miles (500 km; 310 miles)
Mi-17, max AUW	251 n miles (465 km; 289 miles)
Mi-172, max AUW	267 n miles (495 km; 307 miles)
Range at 500 m (1,640 ft), max AUW, 30 min reserves:	
Mi-17M-IV, standard fuel	251 n miles (465 km; 289 miles)
Mi-171, standard fuel	334 n miles (620 km; 385 miles)
Mi-171, standard fuel plus one auxiliary tank	440 n miles (815 km; 506 miles)
Mi-17M, standard fuel plus two auxiliary tanks	545 n miles (1,010 km; 627 miles)
Mi-171, standard fuel plus two auxiliary tanks	575 n miles (1,065 km; 661 miles)
Mi-17M, standard fuel plus four auxiliary tanks	809 n miles (1,500 km; 932 miles)

MIL Mi-26

NATO reporting name: Halo

TYPE: Heavy lift helicopter.

PROGRAMME: Development started early 1970s (initially as Mi-6M); aim was payload capability 1½ to 2 times greater than that of any previous production helicopter; first prototype flew 14 December 1977; first production aircraft rolled out October 1980; one of several prototype or preproduction Mi-26s (SSSR-06141) displayed at 1981 Paris Air Show; in-field evaluation, probably with military development squadron, began early 1982; fully operational 1983; export deliveries started (to India) June 1986; production continues at low rate, with manufacture and marketing by Rostvertol.

CURRENT VERSIONS: **Mi-26: (Izdelie: 90)** Basic military transport.

Detailed description applies to basic Mi-26, except where indicated.

Mi-26A: Modified military Mi-26, tested in 1985, with PNK-90 integrated flight/nav systems for automatic approach and descent to critical decision point, and other tasks. Not proceeded with.

Mi-26T: Basic civil transport (Izdelie 209), generally as military Mi-26. Production begun in 1985. Variants include **Geological Survey Mi-26** towing seismic gear, with tractive force of 10,000 kg (22,045 lb) or more, at 97 to 108 kt (180 to 200 km/h; 112 to 124 mph) at 55 to 100 m (180 to 330 ft) for up to 3 hours. The mockup of an Mi-26 two-crew flight deck was shown at the 1997 Moscow Air Show and again at Farnborough 2002, when Rostvertol said decision to install new avionics on helicopter dependent upon outcome of discussions undertaken at Farnborough; if go-ahead was given, new designation **Mi-26T2** would apply. New avionics suite planned to include PNK-26M flight-navigation system, incorporating five colour MFDs, two data input panels and a digital computer, plus GPS receiver and digital map and weather radar; increased automation would eliminate need for navigator/communications operator and flight engineer, although loadmaster retained. Military equivalent adapted for night operations, using OVN-1 Skosok NVGs and GOES-321 gyro-stabilised observation turret, containing a FLIR sensor and a laser range-finder. No designation announced for military versions. Mi-26T2 to be offered to Brazil, which has requirement for four heavy lift helicopters and is expected to invite bids in near future.

Mi-26TS: (sertifitsyrovannyi: certified) Mi-26T (Izdelie 219), but prepared for certification and marketed (in West as **Mi-26TC**) from 1996. One delivered to Samsung Aerospace Industries of South Korea in September 1997; supplied with Twin Bambi Bucket fire-suppressant system and fulfils dual transport/firefighting roles. This version is also subject of upgrade proposal involving installation of new avionics suite and other improvements that will reduce crew numbers from five to three and offer benefits in area of operational effectiveness; if implemented, is expected to result in improved helicopter becoming available in about 2006.

Mi-26MS: Medical evacuation version of Mi-26T, typically with intensive care section for four casualties and two medics, surgical section for one casualty and three medics, pre-operating section for two casualties and two medics, ambulance section for five stretcher patients, three seated casualties and two attendants; laboratory; and amenities section with lavatory, washing facilities, food storage and recreation unit. Civil version in use by MChS Rossii (Ministry of Emergency Situations). Alternative medical versions available, with modular box-laboratories or fully equipped medical centres that can be inserted into the hold for anything from ambulance to field hospital use. As field ambulance can accommodate up to 60 stretcher patients; or seven patients in intensive care, 32 patients on stretchers and seven attendants; or 47 patients and eight attendants in other



Indian Air Force Mil Mi-26 'Halo' (IAF)

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configurations, which can include 12 bunks in four tiers forward, or patent Rostvertol box laboratory behind the first row of bunks, with 16 bunks behind.

The box includes an operating table, diagnostic equipment, anaesthetic and breathing equipment and other systems. Another configuration includes a larger theatre box by Heinkel Medizin Systeme and 12 stretchers behind, and the helicopter can be fitted with an X-ray laboratory or form the central element of a deployable air-portable field hospital.

Mi-26NEF-M: ASW version with search radar in undernose faired radome, extra cabin heat exchangers and towed MAD housing mounted on ramp.

Mi-26P: Transport for 63 passengers, basically four abreast in airline-type seating, with centre aisle; lavatory, galley and cloakroom aft of flight deck.

Mi-26PK: Flying crane (*kran*) derivative of Mi-26P with operator's gondola on fuselage side, next to cabin door on port side. First produced in 1997.

Mi-26PP: Reported ECM version. First noted 1986; current status unknown.

Mi-26B: Hastily developed version for disaster relief tasks following explosion at Chernobyl nuclear facility; equipped with deactivating liquid tank and underbelly spraying apparatus.

Mi-26TM: Flying crane, with gondola for pilot/sling supervisor under fuselage aft of nosewheels or under rear-loading ramp. First produced in 1992.

Mi-26TP: Firefighting (*pocharnyi*) version that appeared in 1994, with internal tanks able to dispense up to 15,000 litres (3,962 US gallons; 3,300 Imp gallons) fire retardant from one or two vents, or 17,260 litres (4,560 US gallons; 3,796 Imp gallons) of water from an underslung VSU-15 bucket, or from two linked EP-8000 containers. Can fill tanks on the ground using pumps with 3,000 litres (793 US gallons; 660 Imp gallons)/min throughput. One delivered to Moscow Fire Brigade on 19 August 1999.

Mi-26TZ: Tanker version that emerged in 1998, with 14,040 litres (3,710 US gallons; 3,088 Imp gallons) of T2, TS1 or R2 aviation fuel or DL, DZ or DA diesel oil fuel and 1,040 litres (275 US gallons; 228 Imp gallons) lubricants (in 52 jerry cans), dispensed through four 60 m (197 ft) hoses for aircraft, or 10 20 m (66 ft) hoses for ground vehicles. Conversion to/from Mi-26T takes 1 hour 25 minutes for each operation.

Mi-26M: Upgrade under development; all-GFRP main rotor blades of new aerodynamic configuration, new ZMKB Progress D-127 turboshafts (each 10,700 kW; 14,350 shp), and modified integrated flight/nav system with EFIS. Transmission rating unchanged, but full payload capability maintained under 'hot-and-high' conditions. OEI safety improved, hovering and service ceilings increased, and greater maximum payload (22,000 kg; 48,500 lb) for crane operations.

Two prototypes of a command support version of the Mi-26 are reported to have been built in 1988, with designation **Mi-27**. These featured new antennas along lower 'corner' of fuselage, blade and box-type and with long folded masts which are horizontal in flight, vertical when deployed on ground. Orders for production helicopters do not appear to have been placed.

CUSTOMERS: Nearly 300 said to have been built by 2001. Reportedly sold to about 20 countries; operators include Belarus (15), Cambodia (two), Congo Democratic Republic (one; second example delivered in late 2005, following long period of storage at Bierst, Belgium), India (10), Kazakhstan, North Korea (two), South Korea (one), Mexico (two second-hand) in 2000, Peru (three), Russian Army (35), Russian Ministry of Emergencies, Mil-Avia and Ukraine (20). Russian Army deliveries included four in 1994 (but none subsequently). One attrition replacement ordered in 2003 for Siberian division of MChS Rossi emergency relief service. In April 2004, it was reported that Pakistan armed forces negotiating supply of unspecified number of Mi-26s; no further news has emerged of this possible sale. One Mi-26T included in bulk purchase of 10 Mil helicopters by Venezuelan Defence Ministry, according to announcement of May 2005.

COSTS: USD8 million to USD10 million (Mi-26T) (2000).

DESIGN FEATURES: Largest ever production helicopter; empty weight comparable to that of Mi-6 and, as specified, is approximately 50 per cent of maximum T-O weight; weight saved by in-house design of main gearbox providing multiple torque paths, GFRP tail rotor blades, titanium main and tail rotor heads, main rotor blades of mixed metal and GFRP, use of aluminium-lithium alloys in airframe; conventional pod and boom configuration, but first successful use of eight-blade main rotor, of smaller diameter than Mi-6 rotor; payload and cargo hold size similar to those of Lockheed C-130 Hercules; auxiliary wings not required; rear-loading ramp/doors; main rotor rpm 132; main rotor spindle inclined forwards 4°.

FLYING CONTROLS: Hydraulically powered cyclic and collective pitch controls actuated by small parallel jacks, with redundant autopilot and stability augmentation system inputs. Fly-by-wire system flight tested 1994.

STRUCTURE: Eight-blade constant-chord main rotor; flapping and drag hinges, droop stops and hydraulic drag dampers; no elastomeric bearings or hinges; each blade has one-piece tubular steel spar and 26 GFRP aerofoil shape full-chord pockets, honeycomb filled, with ribs and stiffeners and non-removable titanium leading-edge abrasion strip; blades have moderate twist, taper in thickness toward tip, and are attached to small forged titanium head of unconventional design; each has ground-adjustable trailing-edge tab; five-blade constant-chord tail rotor, starboard side, has GFRP blades, forged titanium head; conventional transmission, with tail rotor shaft inside cabin roof; all-metal riveted semi-monocoque fuselage with clamshell rear doors; flattened tailboom undersurface; engine bay of titanium for fire protection; all-metal tail surfaces; swept vertical stabiliser/tail rotor support profiled to produce sideways lift; ground-adjustable variable incidence horizontal stabiliser.

LANDING GEAR: Non-retractable tricycle type; twin wheels on each unit; steerable nosewheels, tyre size 900x300; mainwheel tyres size 1,120x450. Retractable tailskid at end of tailboom to permit unrestricted approach to rear cargo doors. Length of main legs adjusted hydraulically to facilitate loading through rear doors and to permit landing on varying surfaces. Device on main gear indicates take-off weight to flight engineer at lift-off, on panel on shelf to rear of his seat.

POWER PLANT: Two 8,500 kW (11,399 shp) ZMKB Progress D-136 free-turbine turboshafts, side by side above cabin, forward of main rotor driveshaft. Air intakes fitted with particle separators to prevent foreign object ingestion, and have both electrical and bleed air anti-icing systems. Above and behind is central oil cooler intake. VR-26 fan-cooled main transmission, rated at 14,914 kW (20,000 shp), with air intake above rear of engine cowlings. System for synchronising output of engines and maintaining constant rotor rpm; if one engine fails, output of other is increased to maximum power automatically. Independent fuel system for each engine; fuel in eight underfloor rubber tanks, feeding into two header tanks above engines, which permit gravity feed for a period in emergencies; maximum standard internal fuel capacity 12,000 litres (3,170 US gallons; 2,640 Imp gallons); provision for four auxiliary tanks. Mi-26TS normal capacity is 13,020 litres (3,440 US gallons; 2,864 Imp gallons). Two large panels on each side of main rotor mast fairing, aft of engine exhaust outlet, hinge downward as work platforms.

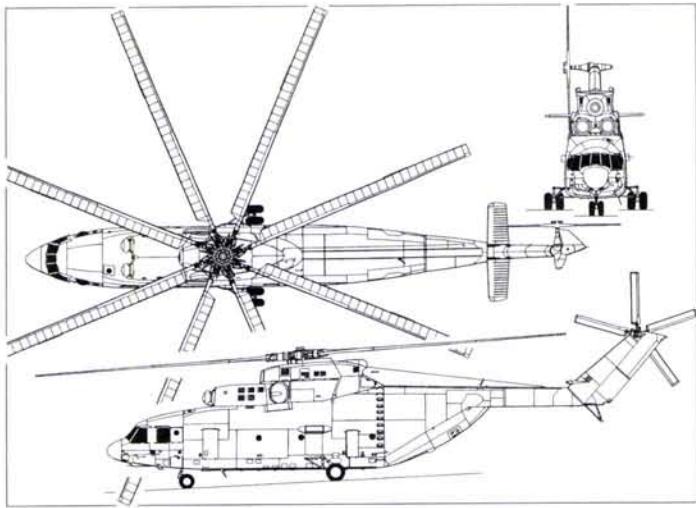
ACCOMMODATION: Crew of five on flight deck: pilot (on port side) and co-pilot side by side, tip-up seat between pilots for flight technician, and seats for flight engineer (port) and navigator (starboard) to rear; upgrade proposal revealed in early 2001 involves installation of new avionics and will result in reduction of flight deck crew to three. Four-seat passenger compartment aft of flight deck. Loads in hold include two airborne infantry combat vehicles and a standard 20,000 kg (44,090 lb) ISO container; about 20 tip-up seats along each sidewall of hold; maximum military seating for 90 combat-equipped troops; alternative provisions for 60 stretcher patients and four/five attendants; or up to maximum of 82 passengers. Heated windscreen, with wipers; four large blistered side windows on flight deck; forward pair swing open slightly outward and rearward. Downward-hinged doors, with integral airstairs, at front of hold on port side, and each side of hold aft of main landing gear units. Hold loaded via downward-hinged lower door, with integral folding ramp, and two clamshell upper doors forming rear wall of hold when closed; doors opened and closed hydraulically, with back-up hand pump for emergency use. Two LG-1500 electric hoists on overhead rails, each with capacity of 2,500 kg (5,511 lb), enable loads to be transported along cabin; winch for hauling loads, capacity 500 kg (1,100 lb); roller conveyor in floor and load lashing points throughout hold. Flight deck fully air conditioned.

SYSTEMS: Two main and one emergency hydraulic systems, operating pressure 157 and 206 bar (2,276 and 2,987 lb/sq in). Electrical system three-phase 200/115 V 400 Hz; single-phase 115 V 400 Hz; three-phase, 36 V 400 Hz; single-phase 36 V 400 Hz; DC 27 V. TA-8V 119 kW (160 hp). APU under flight deck, with intake louvres (forming fuselage skin when closed) and exhaust on starboard side, for engine starting and to supply hydraulic, electrical and air conditioning systems on ground. Electrically heated leading-edge of main and tail rotor blades for anti-icing. Only flight deck pressurised.

AVIONICS: All items necessary for day and night operations in all weathers are standard.

Radar: Groza 7A813 weather radar in hinged (to starboard) nosecone.

Flight: Integrated PKV-26-1 flight/nav system and automatic flight control system, Doppler, map display, HSI, and automatic hover system. Optional GPS.



Mil Mi-26 multipurpose heavy-lift helicopter (Paul Jackson) 1151996

Self-defence: Military versions can have IR jammers and suppressors, IR decoy dispensers and colour-coded identification flare system.
EQUIPMENT: Hatch for load sling in bottom of fuselage, in line with main rotor shaft; sling cable attached to internal winching gear. Closed-circuit TV cameras to observe slung payloads. Specialised versions can utilise firefighting equipment.
ARMAMENT: None.

DIMENSIONS, EXTERNAL:

Main rotor diameter	32.00 m (105 ft 0 in)
Tail rotor diameter	7.61 m (24 ft 11½ in)
Length: overall, rotors turning	40.025 m (131 ft 3¼ in)
nose to turning tail rotor	35.91 m (117 ft 9¼ in)
fuselage, excl tail rotor	33.745 m (110 ft 8½ in)
Height: to top of rotor head	8.145 m (26 ft 8¾ in)
to top of fin	7.45 m (24 ft 5¼ in)
tail rotor turning	11.60 m (38 ft 0¾ in)
Width overall (outsides of mainwheels)	6.15 m (20 ft 2¼ in)
Tailplane span	6.02 m (19 ft 9 in)
Wheel track: c/l shock-absorbers	5.00 m (16 ft 4¾ in)
outer wheels	5.75 m (18 ft 10½ in)
Wheelbase	8.95 m (29 ft 4½ in)

DIMENSIONS, INTERNAL:

Freight hold:	
Length: excl ramp	12.08 m (39 ft 7½ in)
ramp trailed	15.00 m (49 ft 2½ in)
Max width	3.25 m (10 ft 8 in)
Height	2.91–3.17 m (9 ft 6½ in–10 ft 4¾ in)
Floor area: excl ramp	39.3 m² (423 sq ft)
ramp trailed	49.2 m² (530 sq ft)
Volume: excl ramp	121.0 m³ (4,273 cu ft)
ramp trailed	135.9 m³ (4,799 cu ft)

AREAS:

Main rotor disc	804.25 m² (8,656.8 sq ft)
Tail rotor disc	45.48 m² (489.54 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	29,000 kg (63,934 lb)
Max payload, internal or external	20,000 kg (44,090 lb)
Normal T-O weight:	
except Mi-26TS	49,600 kg (109,350 lb)
Mi-26TS	49,650 kg (109,455 lb)
Max T-O weight	56,000 kg (123,450 lb)
Max disc loading: Mi-26TS	69.6 kg/m² (14.26 lb/sq ft)
Transmission loading at max T-O weight and power:	
Mi-26TS	3.76 kg/kW (6.17 lb/shp)

PERFORMANCE (A: Mi-26, B: Mi-26M, C: Mi-26TS at normal T-O weight):

Max level speed: A	159 kt (295 km/h; 183 mph)
C	146 kt (270 km/h; 168 mph)
Normal cruising speed: A, C	137 kt (255 km/h; 158 mph)
Service ceiling: A	4,600 m (15,100 ft)
B	5,900 m (19,360 ft)
C	4,300 m (14,100 ft)
Hovering ceiling IGE:	
A, ISA, with 5,100 kg (11,240 lb) payload	1,000 m (3,280 ft)
B, ISA + 15°C, with 12,300 kg (27,115 lb) payload	1,000 m (3,280 ft)
Hovering ceiling OGE, ISA: A	1,800 m (5,900 ft)
B	2,800 m (9,180 ft)
C	1,520 m (4,980 ft)
Range: A at 2,500 m (8,200 ft) ISA + 15°C, with 7,700 kg (16,975 lb) payload	270 n miles (500 km; 310 miles)
B at 2,500 m (8,200 ft) ISA + 15°C, with 13,700 kg (30,200 lb) payload	270 n miles (500 km; 310 miles)
A, S/L ISA, with max internal fuel at max T-O weight, 5% reserves	318 n miles (590 km; 366 miles)
A, S/L ISA, with four auxiliary tanks	1,028 n miles (1,905 km; 1,183 miles)

MIL Mi-28

NATO reporting name: Havoc
TYPE: Attack helicopter.
PROGRAMME:

DEVELOPMENT MILESTONES

Design began	1980
First flight	10 Nov 1982

Design started 1980 under Marat N Tishchenko; first of two flying Mi-28 prototypes (012) flew 10 November 1982; each prototype different: first and second (022) had upward-pointing exhaust diffusers and fixed undernose fairing for electro-optic equipment; first also had conventional three-blade tail rotor; second replaced this with the definitive 'Delta-H' configuration. The first Mi-28A (032) introduced the downward-pointing exhaust suppressors and flew in January 1988; second Mi-28A prototype (042) demonstrated at Moscow in 1992 and represented the intended production configuration. It had the definitive moving E-O sensor turret undernose, downward-pointing exhaust diffusers and wingtip electronics/chaff dispenser pods.

Following official assessment, Kamov Ka-50 was announced on 5 October 1994 as Russian Army's future light combat helicopter, in preference to Mi-28, and received order for small batch for State Tests. (Army Aviation was absorbed by Russian Air Forces on 1 January 2003.) However, Mi-28N programme kept active by Rostvertol at Rostov-on-Don, which maintained readiness to launch production. By late 2003, Mi-28N's fortunes had revived and this confirmed in January 2004 by Air Forces C-in-C in announcement that it was "being considered" as next generation attack helicopter, partnered by small number of Ka-52 (two-seat Ka-50s) in intelligence-gathering role. Defence minister Sergey Ivanov declared in August 2004 that Mi-28 would be included in equipment of two mountain brigades to be formed in North Caucasus Military District. By mid-2004, official sources were referring to delivery of 50 Mi-28Ns by 2010 and long-term plans to acquire 500. Rostvertol announced in February 2005 that it had begun series production of Mi-28N with fourth and fifth examples on assembly line at Rostev-on-Don by the beginning of July. Entry into Russian Air Force service now expected towards end of 2006.

CURRENT VERSIONS: **Mi-28:** First two prototypes with 1,434 kW (1,923 shp) TV3-117BM engines and VR-28 gearbox.**Mi-28A** (Type 280): Basic version, as described in detail. Third and fourth aircraft built.

Mi-28N: (*Nochnoy*: Night): Export marketing name: Night Hunter. Added night/all-weather operating capability. Russian Army funding announced January 1994: first prototype (OP1/014) modified from original Mi-28 prototype (012); first hover 14 November 1995; formal roll-out 16 August 1996; first flight 30 April 1997. Problems reportedly experienced with original VR-28 main gearbox caused long stand-down, which ended 24 April 2002, following installation of advanced VR-29 replacement main gearbox; by August 2003, prototype said to have accumulated only 20 flight hours. Mi-28N OP1 grounded by early 2006, when employed to test advanced avionics systems.

Mast-mounted 360° scan millimetre wave radar (pod soon enlarged in vertical plane); FLIR ball beneath missile-guidance nose radome and above new shuttered turret for optical/laser sensors, including Zenit low-light-level TV. EFIS cockpit. Armament of production version to include 9M114 Shturm (AT-6 'Spiral') or 9M120 Vihkr/Ataka (AT-12 'Swinger') ASMs and Igla (SA-16 'Gimlet') AAMs and R-73 AAMs. New composites rotor with sweptback blade tips added subsequently. Mi-28N introduced upgraded VR-29 transmission and IKBO integrated flight/weapon aiming system, with automatic terrain-following and automatic target search, detection, identification and (in formations of Mi-28Ns) allocation; Ramenskoye Breo-28N mission control system.

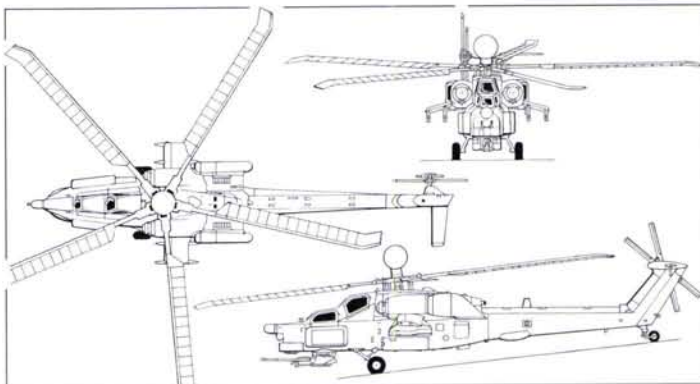
Second Mi-28N prototype (OP2) produced by Rostvertol with joint funding by Yugo-Zapadnyy Bank; rolled out at Rostov 9 March 2004; first flight (as '02': later renumbered '024') 25 March 2004; press and VIP demonstration 31 March 2004; following factory tests, departed Rostov for State Tests in Moscow Region, 18 January 2005, with Stage A of official trials beginning late June 2005. First production helicopter rolled out (c/n 0101) August 2004; due for completion of outfitting in first half of 2005 but official contract for three production examples was not signed until second quarter of 2005; first flight eventually achieved 27 December 2005; handed over to Russian Defence Ministry (as '32') 29 May 2006. Second production example assigned to State Tests by joint Mil and Russian Air Force team. Official programme reported to have begun by mid-2005 and will require 600 sorties. Initial production batch reportedly numbers seven, although 2006 acquisition plan said to involve total of eight, comprising initial three under 2005 contract with five more to be ordered in 2006. Air Forces' C-in-C stated June 2006 that seven due by end of year; 12 for purchase in 2007; 40 in service by 2010; and Mi-24 'Hind' entirely replaced by 2015.

Almaz-280 mast-mounted radar originally planned for use by Mi-28N, but subsequently rejected, with alternatives under consideration; these include N025 radar from GRPZ plant in Ryazan, which undergoing bench-testing in latter half of 2005.

Mi-28NE: (*Nochnoy, Ehksport*: Night, Export): Version offered to, and rejected by, South Korea in 2000. Evaluated by Swedish Army in 2001 against Boeing AH-64 Apache and Eurocopter Tiger. Also offered to India and Malaysia, as well as Turkey, which still has requirement for 50 attack helicopters, following collapse of attempt to purchase Bell AH-1Z King Cobra from USA. Is a candidate to fulfil China's requirement for an attack helicopter. In June 2006, Rostvertol notified willingness to install Western avionics if required by potential customers including Brazil and Saudi Arabia.

COSTS: Mi-28N development cost USD150 million (2000); unit cost approximately USD12 million (Rostvertol, 2004).

DESIGN FEATURES: Conventional gunship configuration, with two crew in stepped cockpits; original three-blade tail rotor superseded by low noise 'scissors' or 'Delta-H' type comprising two independent two-blade rotors set as narrow X (35°/145°) on same shaft with self-lubricating bearings; resulting flapping freedom relieves flight loads; agility enhanced by doubling hinge offset of main rotor blades compared with Mi-24; survivability emphasised; crew compartments protected by titanium and ceramic armour and armoured glass transparencies; single hit will not knock out both engines; new composites main rotor can withstand hit from round of up to 30 mm calibre; vital units and parts are redundant, widely separated and shielded by the less vital; multiple self-sealing fuel tanks in



Mil Mi-28N combat helicopter (two Klimov TV3-117VMA turboshafts) (James Goulding) 0507528



Mil Mi-28N '024' displaying at Moscow Salon in August 2005 (Yefim Gordon)

1153784

centre-fuselage enclosed in composites second skin, outside metal fuselage skin; no explosion, fire or fuel leakage results if tanks hit by bullet or shell fragment; energy absorbing seats and landing gear protect crew in crash landing at descent rate of 12 m (40 ft)/s; crew doors are rearward-hinged, to open quickly and remain open in emergency; parachutes are mandatory for Russian Federation and Associated States (CIS) military helicopter aircrew; if Mi-28 crew had to parachute, emergency system would jettison doors, blast away stub-wings, and inflate bladder beneath each door sill; as crew jumped, they would bounce off bladders and clear main landing gear; no provision for rotor separation; port-side door, aft of wing, provides access to avionics compartment large enough to permit combat rescue of two or three persons on ground, although it lacks windows, heating and ventilation.

Hand crank, inserted into end of each stub-wing, enables stores of up to 500 kg (1,100 lb) to be winched on to pylons without hoists or ground equipment; current 30 mm gun is identical with that of RFAS army ground vehicles and uses same ammunition; jamming averted by attaching twin ammunition boxes to sides of gun mounting, so that they turn, elevate and depress with gun; main rotor shaft has 5° forward tilt, providing tail rotor clearance; transmission capable of running without oil for 20 to 30 minutes; main rotor rpm 242; with main rotor blades and wings removed, helicopter is air-transportable in Il-76 freighter.

FLYING CONTROLS: Hydraulically powered mechanical type; horizontal stabiliser linked to collective; controls for pilot only.

STRUCTURE: Five-blade main rotor; blades have very cambered high-lift section and sweptback tip leading-edge; full-span upswept tab on trailing-edge of each blade; structure comprises numerically controlled, spirally wound glass fibre D-spar, blade pockets of Kevlar-like material with Nomex-like honeycomb core, and titanium erosion strip on leading-edge; each blade has single elastomeric root bearing, mechanical droop stop and hydraulic drag damper; four-blade GFRP tail rotor with elastomeric bearings for flapping; rotor brake lever on starboard side of cockpit; strong and simple machined titanium main rotor head with elastomeric bearings, requiring no lubrication; power output shafts from engines drive main gearbox from each side; tail rotor gearbox, at base of tail pylon, driven by aluminium alloy shaft inside composites duct on top of tailboom; sweptback mid-mounted wings have light alloy primary box structure, leading— and trailing-edges of composites; no wing movable surfaces; provision for countermeasures pod on each wingtip, housing chaff/flare dispensers and sensors, probably RWR; light alloy semi-monocoque fuselage, with titanium armour around cockpits and vulnerable areas; composites access door aft of wing on port side; swept fin has light alloy primary box structure, composites leading— and trailing-edges; cooling air intake at base of fin leading-edge, exhaust at top of trailing-edge; two-position composites horizontal stabiliser.

LANDING GEAR: Non-retractable, tailwheel type; single wheel on each unit; mainwheel tyres size 720x320, pressure 5.40 bar (78 lb/sq in); castoring tailwheel with tyre size 480x200.

POWER PLANT: Two Klimov TV3-117VMA turboshafts, each 1,636 kW (2,194 shp), in pod above each wingroot; three jetpipes inside downward-deflected composites nozzle fairing on each side of third prototype shown in Paris 1989; upward deflecting type also tested. Deflectors for dust and foreign objects forward of air intakes, which are de-iced by engine bleed air. Internal fuel capacity 1,720 litres (454 US gallons; 378 Imp gallons). Provision for four external fuel tanks on underwing pylons.

ACCOMMODATION: Navigator/gunner in front cockpit; pilot behind, on elevated seat; transverse armoured bulkhead between; flat non-glint tinted transparencies of armoured glass; navigator/gunner's door on port side, pilot's door on starboard side.

SYSTEMS: Cockpits air conditioned and pressurised by engine bleed air. Duplicated hydraulic systems, pressure 152 bar (2,200 lb/sq in). 208 V AC electrical system supplied by two generators on accessory section of main gearbox, ensuring continued supply during autorotation. Low-airspeed system standard, giving speed and drift via main rotor blade-tip pitot tubes at -27 to +38 kt (-50 to +70 km/h; -31 to +43 mph) in forward flight, and ±38 kt (±70 km/h; ±43 mph) in sideways flight. Main and tail rotor blades electrically de-iced. Ivchenko AI-9V APU in rear of main pylon structure supplies compressed air for engine starting and to drive small turbine for preflight ground checks.

AVIONICS: Radar: N025 X/Ka-band mast-mounted radar expected to be installed in production helicopters following completion of trials programme.

Comms: UHF/VHF nav/com; small IFF fairing each side of nose and tail.

Instrumentation: Conventional IFR instrumentation, with autostabilisation, autohover, and hover/heading hold lock in attack mode; pilot has HUD and centrally mounted CRT for basic TV; aircraft designed for use with night vision goggles.

Mission: Radio for missile guidance in nose radome, Daylight optical weapons sight and laser range-finder in gyro-stabilised and double-glazed nose turret above gun, with which it

rotates through ±110°; wiper on outer glass protects inner optically flat panel.

Self-defence: Two fixed IR sensors on initial basic production Mi-28; IR suppressors, radar and laser warning receivers standard; optional countermeasures pod on each wingtip, housing chaff/flare dispensers and sensors, probably RWR. Mi-28N has integrated Vitebsk DASS with Pastel RWR, Mak IR warning system, Platan jammer and UV-26 flare dispensers.

EQUIPMENT: Two slots, one above the other on port side of tailboom, for colour-coded identification flares. Three pairs of rectangular formation-keeping lights in top of tailboom; further pair in top of main rotor pylon fairing.

ARMAMENT: One 2A42 30 mm turret-mounted gun (with 250 rounds in side-mounted boxes) in NPPU-28 mount at nose, able to rotate ±110°, elevate 13° and depress 40°; maximum rate of fire 900 rds/min air-to-air and air-to-ground. Two pylons under each stub-wing, each with capacity of 480 kg (1,058 lb), typically for total of sixteen 9M114 Shturm C (AT-6 'Spiral') radio-guided tube-launched anti-tank missiles and two UB-20 pods of eighty 80 mm S-8 or twenty 122 mm S-13 rockets or two UPK-23-250 gun pods. Alternative ATMs include Shipunov 9M120/9M121F Vikhr/Ataka-V and 9A-2200; up to eight 9M39 Igla-V AAMs in place of ATMs; in minelaying role can carry two KGMU-2 dispensers. Main 2A42 gun fired and guided weapons launched normally only from front cockpit; unguided rockets fired from both cockpits. (When fixed, gun can also be fired from rear cockpit.)

DIMENSIONS, EXTERNAL:

Main rotor diameter	17.20 m (56 ft 5 in)
Main rotor blade chord	0.67 m (2 ft 2½ in)
Tail rotor diameter	3.84 m (12 ft 7¼ in)
Tail rotor blade chord	0.24 m (9½ in)
Length overall, incl rotors, incl gun	17.01 m (55 ft 9¾ in)
Fuselage max width	1.85 m (6 ft 1 in)
Width over stub-wings	4.88 m (16 ft 0¼ in)
Height: overall	4.70 m (15 ft 5 in)
to top of rotor head	3.82 m (12 ft 6½ in)
Wheel track	2.29 m (7 ft 6¼ in)
Wheelbase	11.00 m (36 ft 1 in)

AREAS:

Main rotor disc	232.35 m² (2,501.0 sq ft)
Tail rotor disc	11.58 m² (124.65 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped: 28	7,900 kg (17,416 lb)
28A	8,095 kg (17,846 lb)
28N	8,600 kg (18,960 lb)
Fuel weight: standard internal	1,337 kg (2,947 lb)
with added tanks	1,782 kg (3,928 lb)
Normal T-O weight: 28	10,200 kg (22,487 lb)
28A	10,400 kg (22,928 lb)
28N	10,700 kg (23,589 lb)
28NE	11,000 kg (24,250 lb)
Max T-O weight: 28	11,200 kg (24,691 lb)
28A, 28N	11,500 kg (25,353 lb)
Max disc loading: 28	48.2 kg/m² (9.87 lb/sq ft)
28A, 28N	49.5 kg/m² (10.14 lb/sq ft)

PERFORMANCE:

Max level speed: 28A	162 kt (300 km/h; 186 mph)
28N	172 kt (320 km/h; 199 mph)
28NE	164 kt (305 km/h; 189 mph)
Max cruising speed: 28A	143 kt (265 km/h; 164 mph)
28N, 28NE	145 kt (270 km/h; 168 mph)
Max rate of climb at S/L	816 m (2,677 ft)/min
Service ceiling: 28A	5,800 m (19,020 ft)
28N (-SB3)	5,700 m (10,700 ft)
Hovering ceiling OGE: 28	3,470 m (11,380 ft)
28A, 28N, 28NE	3,600 m (11,820 ft)
28N (-SB3)	4,500 m (14,760 ft)
Radius of action, standard fuel, 10 min loiter at target, 5% reserves	108 n miles (200 km; 124 miles)
Range, max standard fuel, 10% reserves: all	234 n miles (435 km; 270 miles)
Ferry range, 5% reserves	593 n miles (1,100 km; 683 miles)
Endurance with max fuel	2 h
g limits	+3/-0.5

MIL Mi-34

NATO reporting name: Hermit
TYPE: Four-seat helicopter.
PROGRAMME: Design began 1980 at personal request of head of DOSAAF paramilitary training organisation, which had found Mi-2 uneconomical as replacement for Mi-1. Mil designation *Izdelie* 300 (Article 300); chief designer M N Tishchenko; low priority due to military demands for Mi-8, -17 and -24 modifications for operations in Afghanistan. Instruction to proceed issued by USSR Council of Ministers on 10 February 1984.
First hover 17 November 1986; first forward flight 26 December 1986; two prototypes and structure test airframe completed by mid-1987, when exhibited for first time at Paris Air Show; first helicopter built in former USSR to perform normal loop and barrel roll; Stage A tests completed in 123 hours and 280 sorties; Stage B State Tests delayed by loss of one prototype on 27 February 1989, resulting in static test airframe being converted for flight. Following dissolution of DOSAAF (and USSR), State Tests resumed late 1992 and extended to 1996.
Series production began at Arsenyev plant and first aircraft flew 4 November 1993; airframe manufactured by Carpathian Helicopter Production Association; marketed by Mi-Light Helicopters (LVM); Mi-34S/-34C completion was at Moscow plant of LVM, but subsequently reverted to Arsenyev; planned completion of 30 in 1994-95 hampered by lack of funding; five delivered in 1995, one in first half of 1996. State order for resumed manufacture 1996. Marketing initiative, early 1999, planned worldwide establishment of service centres in countries where more than 10 Mi-34s ordered. In mid-2003, production was stated to have temporarily ceased to allow transfer of manufacture to a fully constituted production line, the previous 22 helicopters having been manufactured as 'pre-production' aircraft. Production will resume with 276 kW (370 hp) power plant, development delays with which were due to have been overcome by early 2004, although no announcement of resumed production had been received by the end of the following year.
Trials in 1999 by civil pilot training school at Omsk showed Mi-34 to be 2.8 times cheaper and more effective to operate than current fleet; school to acquire three Mi-34Cs and obtain up to 10 more in long term. Other schools expected to replace ageing Mi-2 with Mi-34.
In 2001, an upgraded variant was proposed with M-14 engine rated at 272 kW (365 hp). IFR instrumentation and auxiliary fuel tank. An agricultural variant was planned for debut in 2003.
CURRENT VERSIONS: **Mi-34S:** Basic version; marketed in Russia as Mi-34; certified by Interstate Aviation Committee Aviation Register (initially at 1,350 kg; 2,976 lb max T-O weight), with helicopter, engine and noise type certificates; meets FAR Pt 27 requirements. (Note that until 1999, all marketing literature for this version used the hybrid Roman/Cyrillic **'Mi-34C'** to indicate certified status.)
Description applies to Mi-34S (Mi-34C), except where indicated.
Mi-34L: Projected version with 261 kW (350 hp) Textron Lycoming TIO-540J piston engine.
Mi-34P: (*patrolnyi*; patrol) Version of Mi-34S, equipped for police duties; Elbit thermal imaging equipment. Renewed interest in 2001 from Gazprom for pipeline patrol.
Mi-34A: Originally with 335 kW (450 shp) Rolls-Royce 250-C20R turboshaft; mockup, with luxury interior, exhibited at Moscow Air Show '95. Promotion recommended in 1999, employing 376 kW (504 shp) Turbomeca TM 319 Arrius 2F turboshaft; MTOW 1,450 kg (3,196 lb); usable fuel increased to 340 litres (89.7 US gallons; 74.8 Imp gallons); accommodation for four passengers, plus pilot; 1.0 m³ (35 cu ft) baggage compartment. None yet built.
Mi-34M1/M2: Projected twin-turbine, six-passenger versions originating in 1981 study; MTOW 2,500 kg (5,511 lb).
Mi-34UT: Announced 2001. Dual control trainer. Unsuccessfully competed against Kazan Ansat in competition, in which decision announced September 2001, to provide 100 training helicopters for Russian armed forces.
Mi-234: VAZ rotary engine. Not built.
CUSTOMERS: Total of 22 delivered from Arsenyev by mid-2003, compared with estimated 425 called for in Russia's 1992-2000 civil aviation development plan. No further production reported, but Arsenyev announced plans for resumed manufacture in February 2006, citing successful outcome to recent sales negotiations. This conditional upon resolution of several 'legal and technical' issues, including international certification of Russian-built helicopters. First three for Mayor's office, Moscow. Others used by Bashkir Airlines for oilfield support and Mi-Avia for patrol and training. One operated by Bosniac and Croat Federation Air Force. Three delivered to Nigerian Air Force in 2001, along with six Mi-35s; these were from first batch of six Mi-34s built at Arsenyev, after pause of several years; further five delivered to Nigeria by end of 2002. LVM (Mil's light helicopter marketing subsidiary) reportedly ordered 20 Mi-34s for construction at Arsenyev in 2001, but only delivery in that year apart from Nigerians was one to Sibneft. In June 2002, Russian sources reported foreign (assumed Nigerian) negotiations for 'several dozen' Mi-34s although only known 2003 production commitment was follow-on batch of four for Nigeria and five for Omsk Civil Aviation Flying and Technical College by end of 2005.
COSTS: US\$400,000, fully equipped (2003).
DESIGN FEATURES: Aerobatic helicopter; intended initially for training and international competition flying; conventional pod and boom configuration; piston engine of same basic type as that in widely used Sukhoi and Yakovlev fixed-wing training aircraft of DOSAAF and Kamov Ka-26 helicopters; suitable also for light utility, mail delivery, observation and

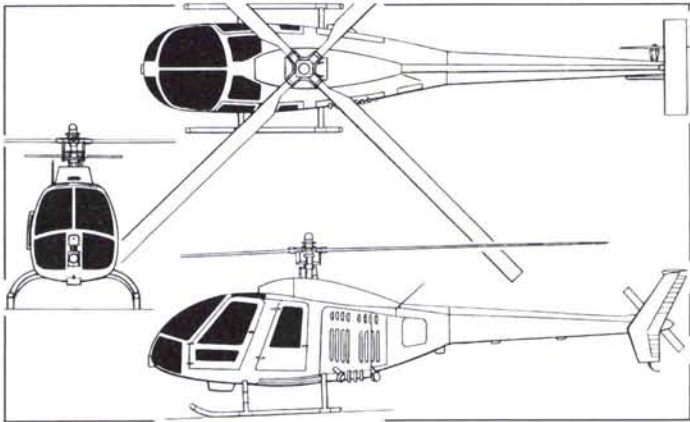


Mil Mi-34P light utility helicopter (Paul Jackson) 1159373

liaison duties, and border patrol; later developments concentrate on light transport role.
Aerobatic capabilities include looping; backwards flight at 70 kt (130 km/h; 81 mph); and rotation about main rotor axis at 60°/s.
FLYING CONTROLS: Manual, with no hydraulic boost.
STRUCTURE: Semi-articulated four-blade main rotor with flapping and cyclic pitch hinges, but natural flexing in lead/lag plane; blades of GFRP built around spiral coil spar of unidirectional glass fibre and with honeycomb filler aft of spar, attached by flexible steel straps to head like that of MDH MD 500; two-blade tail rotor of similar composites construction, on starboard side; riveted light alloy fuselage; sweptback tailfin with small unswept T tailplane. Limited use of titanium alloys.
LANDING GEAR: Conventional fixed skids on arched support tubes; small tailskid to protect tail rotor.
POWER PLANT: One 239 kW (320 hp) VOKBM M-14V-26V nine-cylinder radial air-cooled (fan-assisted) engine mounted sideways in centre-fuselage. Upgrade to 276 kW (370 hp) from 2004. Fuel capacity 176 litres (46.5 US gallons; 38.7 Imp gallons); system for inverted flight.
ACCOMMODATION: Normally one or two pilots, side by side, in enclosed cabin, with optional rapidly removable dual controls. Rear of cabin contains detachable, low bench seat, available for two passengers and offering flat floor for cargo carrying. Forward-hinged door on each side of flight deck and on each side of rear cabin; all doors jettisonable in emergency. Accommodation heated and ventilated; hot air demisting.
SYSTEMS: Primary electric power provided by 27 V 3 kW engine-driven generator; secondary power supplies of 115 V AC, 400 Hz, single-phase and 36 V AC, 400 Hz, three-phase; 27 V 17 Ah battery. Pneumatic system for engine starting.
AVIONICS: *Comms:* Briz VHF radio.
Flight: A-037 radio altimeter; ARK-22 radio compass.
Instrumentation: Magnetically slaved compass system incorporating radio magnetic indicator.
EQUIPMENT: Gyro horizon. Version used by Moscow Police has dual controls, two rear seats and loudspeaker under rear of pod.
DIMENSIONS, EXTERNAL:
Main rotor diameter 10.00 m (32 ft 9 3/4 in)
Main rotor blade chord 0.22 m (8 3/4 in)
Tail rotor diameter 1.48 m (4 ft 10 1/4 in)
Tail rotor blade chord 0.16 m (6 1/4 in)
Length overall, rotors turning 11.415 m (37 ft 5 1/2 in)
Fuselage: Length 8.71 m (28 ft 7 in)
Max width 1.42 m (4 ft 8 in)
Height: overall 2.75 m (9 ft 0 1/4 in)
to fin tip 2.45 m (8 ft 0 1/2 in)
Skid track 2.175 m (7 ft 1 1/2 in)
Fuselage ground clearance 0.36 m (1 ft 2 1/4 in)
Cockpit doors: Height 1.15 m (3 ft 9 1/4 in)
Max width 0.70 m (2 ft 3 1/2 in)
AREAS:
Main rotor disc 78.70 m² (847.1 sq ft)
Tail rotor disc 1.72 m² (18.52 sq ft)
WEIGHTS AND LOADINGS:
Weight empty 950 kg (2,094 lb)
Fuel weight 128 kg (282 lb)
T-O weight: Aerobatic 1,100 kg (2,425 lb)
Normal 1,280 kg (2,822 lb)
Max 1,450 kg (3,196 lb)
Max disc loading 18.4 kg/m² (3.77 lb/sq ft)
Max power loading 6.08 kg/kW (9.99 lb/hp)
PERFORMANCE (Mi-34S/C at Normal TOW; Mi-34A at MTOW):
Max level speed: Mi-34S/C 113 kt (210 km/h; 130 mph)
Mi-34A 121 kt (225 km/h; 140 mph)
Max cruising speed:
Mi-34S/C 92 kt (170 km/h; 106 mph)
Mi-34A 113 kt (210 km/h; 130 mph)
Best climbing speed: Mi-34S/C 49 kt (90 km/h; 56 mph)
Service ceiling: Mi-34S/C 4,000 m (13,120 ft)
Mi-34A 5,000 m (16,400 ft)
Hovering ceiling, OGE: Mi-34S/C 900 m (2,960 ft)
Mi-34A 2,750 m (9,020 ft)
Range with max fuel at 500 m (1,640 ft), 5% reserves:
Mi-34S/C 192 n miles (356 km; 221 miles)
Mi-34A 297 n miles (550 km; 341 miles)
g limit +3

MIL Mi-38

TYPE: Medium transport helicopter.
PROGRAMME: USSR Council of Ministers approved proposal for an 'improved Mil Mi-8' on 30 July 1981, this using (for third time) designation Mi-8M. Optimised for civil operation, and thus sought economical engine and composites rotor blades. Following further refinements, including elastomeric hub, retractable landing gear and X-type tail rotor, was redesignated Mi-38 in 1983. Early work at Kazan branch of Mil design office; transferred to Moscow in January 1988 under A N Ivanov and, from 1995, N I Chalov. Agreement of August 1990 provided for Kazan to build prototypes as cost-saving measure.
Model shown at 1989 Paris Air Show, when aircraft at mockup stage. Modifications in

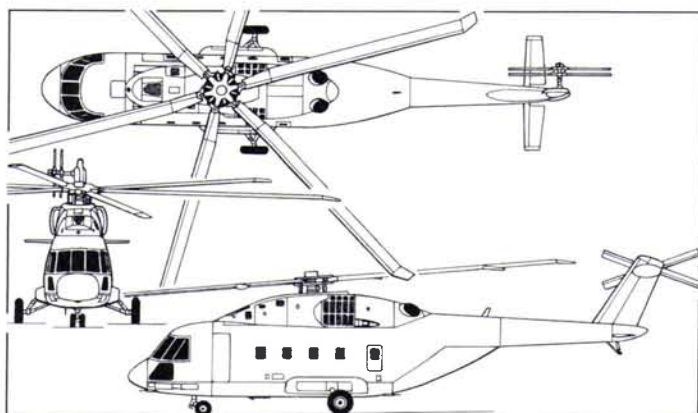


Mil Mi-34 two/four-seat training, competition and light transport helicopter (Dennis Punnett) 1159403



Mil Mi-38 prototype (Yefim Gordon)

1159323



Mil Mi-38 medium transport helicopter (Michael Badrocke)

1159404

evidence by 1993 included fixed landing gear with wider track and reduced base. Under December 1992 agreement, Eurocopter was to integrate flight deck, avionics and passenger systems, and adapt Mi-38 for international market; Euromil joint stock company established September 1994 to advance collaboration, adding Kazan production plant (as main manufacturing and final assembly centre); funding for Euromil granted in October 1994 by European Bank for Reconstruction and Development. Sextant and Pratt & Whitney Canada added as risk-sharing parties for avionics and engine, later replacing Klimov. Funding by Russian Ministry for Defence Industries 1996. In July 2003, however, Eurocopter withdrew from Euromil, which continues as an all-Russian company, but with Eurocopter continuing to supply avionics as a contractor. Mi-38 rotor blades began test flying on an Mi-17 in early 2001.

By 1997, Euromil was anticipating first flight in 1999 and start of production two years later, following FAR Pt 29 certification, but contracts for completion of demonstrator not signed until 18 August 1999, following unilateral decision of Euromil board in December 1998 to launch programme and fly demonstrator at Kazan in 2001. This subsequently slipped to 2002 and then to mid-2003, finally taking place on 22 December 2003, following roll-out on 20 November. Demonstrator (PT-1/RA-38011) is third airframe, following test articles at Mil Moscow and Kazan. First formal presentation held at Kazan on 1 October 2004. Prototype wears 'Euromil' name and European Union flag. Four further prototypes to follow, including two for static testing. Certification planned in 2009.

CURRENT VERSIONS: **Mi-38:** Pratt & Whitney engines.

Mi-38M: Proposed development version with 16,500 kg (36,376 lb) MTOW only when carrying underslung load.

Mi-382: Klimov engines.

Mi-382M: Proposed development version with 18,000 kg (39,683 lb) MTOW only when carrying underslung load of up to 8,000 kg (17,637 lb).

CUSTOMERS: Predicted sales of 200 in CIS, plus 100 exports.

COSTS: Estimated development cost (2001) USD500 million; unit cost USD12 million to USD16 million for export; USD11 million in Russian Federation (2002).

DESIGN FEATURES: Planned as replacement for Mi-8/17 series. Western engines optional.

Conventional pod and boom configuration; power plant above cabin; six-blade main rotor with considerable non-linear twist and swept tips; main rotor has hydraulic drag dampers; single lubrication point, at driveshaft; rotor brake standard; Krasny Otkyabr VR-E8 transmission, comprising main, intermediate and tail gearboxes and tail rotor drive shaft; engine input 19,017 rpm; two independent two-blade tail rotors, set as narrow X on same shaft; sweptback fin/tail rotor mounting; small horizontal stabiliser; for day/night operation over temperature range -60 to +50°C.

FLYING CONTROLS: Fly-by-wire, with manual back-up.

STRUCTURE: Composites main and tail rotors by Kazan; low-profile VNV-E8 titanium main rotor head, with elastomeric bearings, built by Stupino; fuselage, mainly composites, built by Kazan.

LANDING GEAR: Fixed tricycle type; single wheel on each main unit; oleo-pneumatic shock absorbers; twin, self-centring nosewheels; low-pressure tyres; optional pontoons for emergency use in overwater missions. Main tyres 950 mm diameter, pressure 5.88 bar (85 lb/sq in); nose tyres 600 mm diameter, pressure 4.90 bar (71 lb/sq in).

POWER PLANT: Those helicopters for CIS customers powered by two Klimov TVA-3000 (TV7-117 derivative) turboshafts, each rated at 1,838 kW (2,465 shp) for T-O; single-engine rating 2,610 kW (3,500 shp) and transmission rated for same power. Demonstrator to have two 2,461 kW (3,300 shp) P&WC PW127 turboshafts, which are also available, in PW127T/S form, as an option for Western customers. Power plant above cabin, to rear of main reduction gear; air intakes and filters in sides of cowlings. Six fuel tanks beneath floor of main cabin are resistant to 15 m (50 ft) drop without rupturing; normal fuel capacity 3,942 litres (1,041 US gallons; 867 Imp gallons). Provision for external auxiliary fuel tanks. Liquid petroleum gas fuel planned as alternative to aviation kerosene.

ACCOMMODATION: Crew of two on flight deck, separated from main cabin by compartment for majority of avionics; single-pilot operation possible for cargo missions. Cabin includes first 2.07 m (6 ft 9½ in) of tailboom. Lightweight seats for 30 passengers as alternative to unobstructed hold for 5,000 kg (11,020 lb) freight. Ambulance (16 litters) and air survey

versions planned. Passenger door, forward, port; freight door, forward, starboard; cargo ramp at rear; hatch in cabin floor, under main rotor driveshaft, for tactical/emergency cargo airdrop and for cargo sling attachment; optional windows for survey cameras in place of hatch. Provision for hoist over port-side door, remotely controlled, hydraulically actuated rear cargo ramp, powered hoist on overhead rails in cabin, and roller conveyor system in cabin floor and ramp.

SYSTEMS: Air conditioning by compressor bleed air, or APU on ground, maintains temperature of not more than 25°C on flight deck in outside temperature of 40°C, and not less than 15°C on flight deck and in main cabin in outside temperature of -50°C. Three independent hydraulic systems; any one able to maintain control of helicopter in emergency. Electrical system has three independent generators, two at 12 kW DC and one 60 kW AC; optional fourth generator 40 or 60 kW AC; two batteries; electric rotor blade de-icing, main and tail. Independent fuel system for each engine, with automatic crossfeed; forward part of cowlings houses VD-100 APU, hydraulic, air conditioning, electrical and other system components.

AVIONICS: Sextant equipment in export aircraft.

Radar: Weather/nav radar (range 54 n miles; 100 km; 62 miles).

Flight: Preset flight control system allows full autopilot, autohover and automatic landing. Avionics controlled by large central computer, linked also to automatic nav system with Doppler, ILS, satellite nav system, main radar, autostabilisation system and automatic radio compass.

Instrumentation: Six colour CRTs for use in flight and by servicing personnel on ground. Equipment monitoring, failure warning and damage control system. Closed-circuit TV for monitoring cargo loading and slung loads. Options include low-cost electromechanical instrumentation based on that of Mi-8, sensors for weighing and CG positioning of cargo in cabin, and for checking weight of slung loads.

EQUIPMENT: Optional 300 kg (661 lb) capacity SAR hoist.

DIMENSIONS, EXTERNAL:

Main rotor diameter	21.10 m (69 ft 2¾ in)
Tail rotor diameter	3.84 m (12 ft 7¼ in)
Distance between rotor centres	12.755 m (41 ft 10¼ in)
Length: overall, rotors turning	25.20 m (82 ft 8¼ in)
fuselage	19.95 m (65 ft 5½ in)
Width, rotors folded	3.17 m (10 ft 4¾ in)
Height: to top of rotor head	5.20 m (17 ft 0¾ in)
to top of fin	5.56 m (18 ft 3 in)
Stabiliser span	4.20 m (13 ft 9½ in)
Wheel track	4.50 m (14 ft 9¼ in)
Wheelbase	5.17 m (16 ft 11½ in)
Forward freight door: Height	1.665 m (5 ft 5½ in)
Width	1.445 m (4 ft 9 in)
Forward passenger door: Height	1.66 m (5 ft 5¼ in)
Width	0.61 m (2 ft 0 in)
Floor hatch: Length	1.15 m (3 ft 9¼ in)
Width	0.75 m (2 ft 5½ in)

DIMENSIONS, INTERNAL:

Main cabin: Length: at floor	6.80 m (22 ft 3¾ in)
at top of ramp	8.63 m (28 ft 3¾ in)
including available tailboom	10.70 m (35 ft 1¼ in)
Max width	2.36 m (7 ft 9 in)
Width at floor	2.20 m (7 ft 2½ in)
Height: centre	1.84 m (6 ft 0½ in)
rear	1.85 m (6 ft 1 in)
Volume	29.5 m³ (1,042 cu ft)

AREAS:

Main rotor disc	349.67 m² (3,763.8 sq ft)
Tail rotor disc	11.58 m² (124.65 sq ft)

WEIGHTS AND LOADINGS (provisional):

Max payload: internal	5,000 kg (11,020 lb)
external	7,000 kg (15,432 lb)
Max fuel weight	3,055 kg (6,735 lb)
Normal T-O weight	14,200 kg (31,305 lb)
Max T-O weight	15,600 kg (34,392 lb)
Max disc loading	44.6 kg/m² (9.14 lb/sq ft)
Transmission loading at max T-O weight and power	5.97 kg/kW (9.82 lb/shp)

PERFORMANCE (estimated, PW127 engines):

Max level speed	153 kt (285 km/h; 177 mph)
Max cruising speed	148 kt (275 km/h; 171 mph)
Service ceiling	5,100 m (16,740 ft)
Hovering ceiling OGE	2,800 m (9,180 ft)
Range: with 5,000 kg (11,020 lb) payload	256 n miles (475 km; 295 miles)
with max internal fuel	477 n miles (885 km; 549 miles)
ferry, with auxiliary fuel	701 n miles (1,300 km; 807 miles)

MIL Mi-54

TYPE: Multirole medium helicopter.

PROGRAMME: Project announced mid-1992: at preliminary design stage by 1993, to replace Mi-2 and Mi-8; model displayed at Moscow Air Show '92; envisaged initially with two Saturn/Lyulka AL-32 turboshafts; single-engined version for Asian market then being studied; IOC planned 1998, but not achieved. By 2005, had been included in 2002-10 Russian civil aviation plan, following minor revisions of design; mockup shown at Moscow Salon in August 2005, displaying numerous detail differences from previous designs. Further changes reflected in 2006 brochure.

DESIGN FEATURES: Intentions include low operating costs; high safety; spacious cabin; and operability in broad range of temperatures and altitudes. Configuration shown in accompanying illustrations; four-blade composites main and tail rotors.

LANDING GEAR: Tricycle type; fixed single wheel on each main unit, carried below sponsons; twin nosewheels; tailskid.

POWER PLANT: Two Klimov VK-800V turboshafts, each 588 kW (789 shp), mounted side by side above cabin.

ACCOMMODATION: Normal seating for two pilots and up to 12 passengers. Separate baggage compartment.

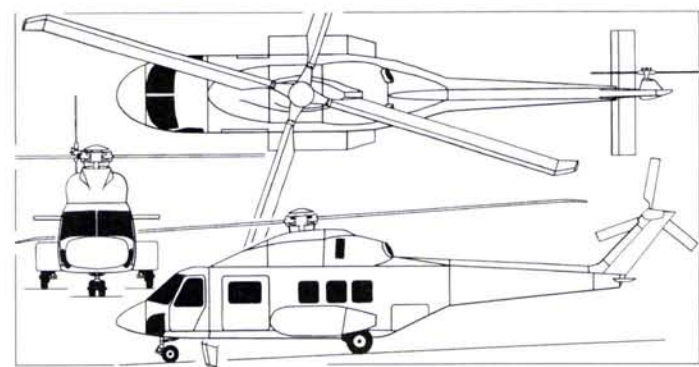
DIMENSIONS, EXTERNAL:

Main rotor diameter	13.50 m (44 ft 3½ in)
Tail rotor diameter	2.70 m (8 ft 10¼ in)
Fuselage: Length	13.13 m (43 ft 1 in)
Width over sponsons	2.90 m (9 ft 6¼ in)
Height to top of rotor head	3.40 m (11 ft 1¾ in)
Wheel track	2.50 m (8 ft 2½ in)
Wheelbase	4.45 m (14 ft 7¼ in)



Model of Mil Mi-54

1159324



Current arrangement of Mil Mi-54 (Paul Jackson)

1159405

DIMENSIONS, INTERNAL:

Cabin: Length at floor	4.25 m (13 ft 11¼ in)
Max width	1.71 m (5 ft 7¼ in)
Max height	1.40 m (4 ft 7 in)
Baggage compartment volume	0.80 m³ (28.3 cu ft)

AREAS:

Main rotor disc	143.14 m² (1,540.7 sq ft)
Tail rotor disc	5.31 m² (57.16 sq ft)

WEIGHTS AND LOADINGS:

Max payload: internal	1,500 kg (3,307 lb)
external	1,800 kg (3,968 lb)
Max T-O weight: internal load	4,500 kg (9,920 lb)
external load	4,700 kg (10,362 lb)
Max disc loading: internal load	31.4 kg/m² (6.44 lb/sq ft)
external load	32.8 kg/m² (6.73 lb/sq ft)

PERFORMANCE (estimated):

Max level speed	154 kt (285 km/h; 177 mph)
Nominal cruising speed	139 kt (257 km/h; 160 mph)
Service ceiling	5,500 m (18,040 ft)
Hovering ceiling: OGE	2,500 m (8,200 ft)
Range, 30 min reserves	324 n miles (600 km; 372 miles)

MIL Mi-60

TYPE: Three-seat helicopter.

PROGRAMME: Development began 1993 under leadership of M N Tishchenko of Moscow Aviation Institute, thus designated Mi-60 MAI; financed by Ministry of Education. Technical proposal completed 1994; sponsored from 1997 by Army Aviation as twin-engine helicopter trainer; improved version with de-icing, autopilot and cabin heating proposed by Rostvertol in 1998. Announced July 2000, when mockup under construction at Kazan



Mockup of Mil Mi-60 MAI exhibited by Rostvertol at Moscow Salon, August 2001 (Paul Jackson)

0121036

helicopter factory; this exhibited at Moscow Salon in August 2001, promoted by Rostvertol, which considering establishing production line. Building of prototype was to have begun in 2001; development cost USD30 million, including USD2.58 million for scientific research and USD15.77 million for prototypes and preparation for series production; estimated unit cost USD140,000 to USD150,000. Programme included in Russian federal aviation plan for 2002-10, but no further announcements made by 2006, when still awaiting investors to launch production.

DESIGN FEATURES: Maintenance-free rotor hub; airframe TBO of 2,000 hours.

LANDING GEAR: Skid type.

POWER PLANT: One or two piston engine driving main gearbox via a belt. Design power plant two LOM M332A four cylinder engines, each 103 kW (138 hp). Option of one 145 kW (195 hp) Textron Lycoming HIO-360-F1AD, one 177 kW (237 hp) VAZ-4261 or two 84.6 kW (113.4 hp) Rotax 914Fs.

DIMENSIONS, EXTERNAL:

Main rotor diameter	10.00 m (32 ft 9¾ in)
Main rotor blade chord	0.22 m (8¾ in)

WEIGHTS AND LOADINGS (estimated; L: Lycoming, R: Rotax, V: VAZ engines):

Fuel weight: L	79 kg (174 lb)
R	70 kg (154 lb)
V	71 kg (157 lb)
Max underslung load	90 kg (198 lb)
T-O weight: Normal: all	800 kg (1,764 lb)
Max: L	1,115 kg (2,458 lb)
R	1,260 kg (2,778 lb)
V	1,300 kg (2,866 lb)

PERFORMANCE (estimated; L, R, V as above):

Max level speed: L	108 kt (200 km/h; 124 mph)
R	113 kt (210 km/h; 130 mph)
V	121 kt (225 km/h; 140 mph)
Max cruising speed: L	94 kt (175 km/h; 109 mph)
R	103 kt (190 km/h; 118 mph)
V	100 kt (185 km/h; 115 mph)
Econ cruising speed: L, V	46 kt (85 km/h; 53 mph)
R	43 kt (80 km/h; 50 mph)
Max rate of climb at S/L:	
vertical: L	228 m (748 ft)/min
R	300 m (984 ft)/min
V	468 m (1,535 ft)/min
inclined: L	444 m (1,457 ft)/min
R	480 m (1,575 ft)/min
V	630 m (2,067 ft)/min
Hovering ceiling, IGE: L	1,800 m (5,900 ft)
R	2,000 m (6,560 ft)
V	3,200 m (10,500 ft)
Service ceiling: L	4,900 m (16,080 ft)
R	5,200 m (17,060 ft)
V	5,500 m (18,040 ft)
Range, all	216 n miles (400 km; 248 miles)
Endurance: L	3 h 40 min
R,V	4 h 20 min

MVEN

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Since establishment in 1990, MVEN has produced Cobra and Rada parachute ballistic recovery systems for various types of aircraft. It is a member of the 27-strong group of innovation centres founded by the Russian Fund of Assistance for Scientific and Technological Development of Small Enterprises (Bortnik's Fund). Core activities include manufacture of light aircraft and consumer goods both of polymer-composites material.

In 1995 it was incorporated within the Scientific Research Institute of Aeronautical Technologies and began the manufacture of light aircraft fuselages and components under subcontract to Chernov and others. The company's first aircraft, the MVEN-1 agricultural sprayer was shown at the Gelendzhik Hydroaviation Salon in September 2002, three months before its maiden flight. Production will be of MVEN-2 version. Longer-term projects include a four-seat business aircraft and six-seat STOL light transport. On 2 July 2003, MVEN received official certification as a designer and constructor of aircraft and parachute recovery systems.

MVEN is Russian dealer for Aeroprakt lightplanes built in Ukraine. Other activities include manufacture of commercial vehicle bodies and operation of a flying school at Kazan's domestic airport. The company has a workforce of 90 at its 9,000 m² (96,875 sq ft) plant.

MVEN FERMER

English name: Farmer

TYPE: Agricultural sprayer.

PROGRAMME: Prototype built 2002. Shown at Gelendzhik, 4 to 8 September 2002. First flight 9 November 2002; official evaluation flight of 11 December gave clearance for continued company testing.

CURRENT VERSIONS: **MVEN-1:** Initial version. Length 6.58 m (21 ft 7 in); one 118 kW (158 hp) LOM M332B four-cylinder piston engine driving a three-blade propeller.

MVEN-2: Announced 2003, with target first flight date of May 2004 (apparently not achieved and no further announcements by end of that year). Lycoming engine. Increased length and weights. Intended production version. By 2005, at least two Lycoming-powered aircraft had been noted: RA-3259K and RA-0180G. As described.

DESIGN FEATURES: Classic low-wing sprayplane with chemical hopper ahead of raised cockpit giving good view over nose. Forward C of P and C of G for improved handling obtained by overlap of cockpit and chemical tank, plus forward wing sweep. Strut-braced, constant-chord wings and tailplane. Heavy-duty suspension and tyres.

Wing forward sweep 2°; dihedral 5°; incidence 3°.

FLYING CONTROLS: Conventional and manual. No aerodynamic balances. Ailerons and flaps occupy full extent of wing trailing-edge. Flap deflections 0°, 20° and 40°.

STRUCTURE: Principally of vacuum-formed glass fibre/epoxy with foam filler. Forward fuselage built around four longerons; X18H9T stainless steel firewall; glass fibre chemical tank with cutouts at rear for pilot's legs.

LANDING GEAR: Tailwheel type; fixed. Centreline-hinged tube Vs attached to pneumatic compression struts, upper ends of which anchored to fuselage sides. Cantilever sprung tailwheel. Hydraulic brakes on mainwheels. Mainwheels 595x185; tailwheel 250x80.



MVEN-1 Fermer (Lycoming engine) at Moscow Salon in 2005 (Yefim Gordan) 1128964

POWER PLANT: One 134 kW (180 hp) Textron Lycoming O-360 flat-four. Fuel in two integral wing tanks, total capacity 140 litres (37.0 US gallons; 30.8 Imp gallons).
ACCOMMODATION: Two persons in tandem. Single, upward-hinged door, port side. Cockpit air filtered. Roll-bar over pilot's seat. Baggage locker to rear.
EQUIPMENT: Chemical tank to rear of engine bay. Sprayer system with 13 atomisers on each of two underwing elements. Coverage 88 to 97 ha (217 to 240 acres) per hour. MVEN ballistic parachute behind cockpit.

DIMENSIONS, EXTERNAL:

Wing span	10.40 m (34 ft 1½ in)
Wing chord, constant	1.25 m (4 ft 1¼ in)
Wing aspect ratio	8.3
Length overall	7.15 m (23 ft 5½ in)

MYASISHCHEV

EKSPERIMENTAL'NYI MASHINOSTROITEL'NYI ZAVOD IMENI V M MYASISHCHEVA
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CHIEF DESIGNER, M-55: Leonid A Sokolov
INFORMATION AND PUBLIC RELATIONS OFFICER: Stanislav G Smirnov

The Myasishchev OKB was founded on 24 March 1951 as OKB-23, and led by Prof Vladimir Mikhailovich Myasishchev until his transfer in 1960 to head of the TsAGI research institute. Reconstituted in 1967, a new bureau was again led by Myasishchev up to his death in 1978. In the 1970s and 1980s, the bureau was engaged in development of multipurpose subsonic high-altitude aircraft, but has more recently diversified into civil aviation. In 1981, the bureau was named after Prof Myasishchev.

Attempts to forge overseas alliances proved unsuccessful, but in April 2001 it was announced that the KASKOL group of companies, the Nizhny Novgorod Sokol Aviation Plant and Myasishchev had formed Novi Regionalnyi Samoletnyi (NoRS, New Regional Aeroplanes), which is producing the M-101T Gzhel business aircraft at Nizhny Novgorod. Deliveries to customers began in 2005.

The bureau lists numerous other projects, although none appears to be close to the prototype stage. These are M-203 Barsuk (Badger), M-500 agricultural sprayer, M-201 Sokol, M-102 Duet (produced in Indian as Saras), M-202, M-112, M-302 19-passenger jet and Ecologiya, Kruiz and S-80 aerostats. Several have been described in previous editions of *Jane's All the World's Aircraft*.

MYASISHCHEV M-101T SOKOL

English name: Falcon
TYPE: Light utility turboprop.
PROGRAMME: Derived from Nelli and M-70 projects; first shown in model form at Moscow Air Show '90; developed full-scale mockup exhibited at Moscow Air Show '92 with piston engine and at Moscow Air Show '93 with turboprop. Two static test airframes and three flying prototypes built at Nizhny Novgorod by Sokol; first (RA-15001) first flew 31 March 1995; this and second flying aircraft (RA-15003), shown at Moscow Air Show '95, lack ventral fin. Third prototype (RA-15004) to what then regarded as preproduction standard; first preproduction aircraft (RA-15101) displayed at Paris and Moscow Air Shows 1997. Initial batch of 12 at Sokol plant; 11 reportedly completed by September 2001; No. 6 (RA-15106) is first in full production configuration, shown at Moscow, August 2001; No. 7 for reliability tests; No. 8 previously intended as first for customer delivery. Trials aircraft crashed near Zhukovsky test aerodrome on 12 September 2001, following loss of longitudinal stability, putting programme back by six months. Certification trials were due to restart in May 2002, with completion scheduled by December 2002; certification to AP-23 eventually awarded 14 January 2003. In April 2002 it was reported that 12 aircraft had been built — 10 for flying trials and two for static testing. Cold weather testing at temperatures as low as -50°C (-58°F) was undertaken in Yakutia, Sakha Republic, in February 2004.

Russian certification to AP-23 in passenger category was expected late 1998 or early 1999, following delivery of two aircraft to State Civil Aviation Research Institute (Gos NII GA) on 23 January 1998 for short-range freight services from Moscow/Shevchenko by Fenix Air but delayed by lack of funding; meanwhile five aircraft used on freight services by Sokol plant, completing 200 sorties and 460 hours between 31 airports between December 1997 and September 1999; one demonstrated in Africa by Central African Airlines, based in Egypt, accumulating 14,000 n miles (26,000 km; 16,150 miles). In November 2001, US\$3 million was being sought to complete certification and further US\$5 million to complete production tooling and retrospectively modify airframes already built. In April 2004, an agreement was announced with Mooney International for

Height overall	2.15 m (7 ft 0¾ in)
Tailplane span	3.76 m (12 ft 4 in)
Propeller diameter	1.93 m (6 ft 4 in)
Crew door: Width	0.70 m (2 ft 3½ in)
DIMENSIONS, INTERNAL:	
Cockpit: Max width	1.22 m (4 ft 0 in)
Max height	0.74 m (2 ft 5 in)
Baggage space: Length	0.58 m (1 ft 10¾ in)
Max height	0.67 m (2 ft 2½ in)
Max width	0.57 m (1 ft 10½ in)
AREAS:	
Wings, gross	13.00 m² (139.9 sq ft)
Ailerons (total)	1.65 m² (17.76 sq ft)
Flaps	2.78 m² (29.92 sq ft)
Fin	1.20 m² (12.92 sq ft)
Rudder	0.80 m² (8.61 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	575 kg (1,268 lb)
Max chemical load	270 kg (595 lb)
Max baggage weight	10 kg (22 lb)
Max T-O weight	980 kg (2,160 lb)
Max wing loading	75.4 kg/m² (15.44 lb/sq ft)
Max power loading	8.31 kg/kW (13.65 lb/hp)
PERFORMANCE:	
Max level speed	108 kt (200 km/h; 124 mph)
Normal operating speed	70–86 kt (130–160 km/h; 81–99 mph)
Max rate of climb at S/L	270 m (885 ft)/min
T-O run	180 m (590 ft)
Landing run	150 m (495 ft)
g limits	+6/-2

assembly of M-101Ts at Greenville for the US market; this appears to have lapsed.

Shortcomings in directional stability addressed by retrospective installation of additional two ventral fins and dorsal fillet on third prototype (RA-15004) in 1999, this also having extended wingtips. These additional tail surfaces standardised from RA-15106 onwards.

The aircraft was originally named Gzhel for a type of fine porcelain made in the city of Gzhel. Some development funding was provided by Gzhel, other finance coming from Myasishchev, Sokol, Inkombank and a Czech bank. Marketing is by Gzhel-Avia. In 2004, name was changed to Expediteon, apparently because of additional, alcoholic connections of Gzhel. By 2005 this had been changed, yet again, to Sokol.

Deliveries of new-build aircraft eventually began in late 2005.

CUSTOMERS: Three flying prototypes and up to six preproduction aircraft completed by 2001; further two may have been finished by 2004. By April 2003, company reported 15 built, with 30 more under construction; delivery of first customer aircraft was due mid-2003, with eight scheduled to be handed over by end 2003 and a further 25 in 2004; by 2004, the company was stating that orders had been received from South Africa and Australia and production for the year would total seven (two for Russia and five abroad), followed by 18 in 2005. First confirmed receipt, in April 2004, by South African dealer, Rosavia Group of Johannesburg, although this was previously built (2001) aircraft RA-15106 which had returned to Russia a few months later. On 15 November 2005, Sokol production plant delivered two M-101T Sokols to civil aviation flying schools at Ulyanovsk and Buguruslan.

In December 2005, Avia Management Group ordered 45 Sokols, valued at USD67.5 million, with deliveries to be complete by mid-2007, for use by Dexter air taxi operation between 17 Russian cities. First (RA-15106) handed over 3 March 2006.

COSTS: USD1.6 million (2001). Hourly operating cost estimated at USD200 (2001). By mid-1999, Sokol plant had invested Rb102.4 million in M-101, and in 2000 was planning funding of USD2.5 million to complete certification.

DESIGN FEATURES: Intended for operation in remote areas; able to serve away from base aerodrome for up to 50 flying hours and fly from unpaved runways. Conventional all-metal low-wing monoplane with pressurised cabin; sweptback vertical tail surfaces and ventral



South African demonstrator Myasishchev M-101T RA-15106 'Ingwe', first and only aircraft to wear type name Expediteon 1042767



Myasishchev M-101T Sokol six-seat light aircraft (Mike Keep) 0121660

fin. Designed in accordance with Russian AP-23 and US FAR Pt 23 airworthiness requirements. Service life of 15 years or 20,000 hours.

FLYING CONTROLS: Conventional and manual. Electrically operated trim tabs in port aileron, rudder and each elevator; ground-adjustable tab on starboard aileron. Double-slotted flaps operated hydraulically.

STRUCTURE: All-metal. Wing constructed around torsion box.

LANDING GEAR: Hydraulically retractable tricycle type; single wheel on each unit; nosewheel retracts rearward, mainwheels inward into wingroots and fuselage; mainwheels uncovered by doors when retracted; tyre size 500x150-9 on mainwheels, 400x150-5 on nosewheel; levered suspension legs; castoring nosewheel with shimmy damper; designed to use paved and unpaved runways.

POWER PLANT: One 559 kW (751 shp) Walter M 601 F32 turboprop, driving Avia Hamilton Sundstrand V-510 five-blade propeller. Power plant is protected against particle ingestion. Fuel in two wing tanks and two feeder tanks, with electrical pumps.

ACCOMMODATION: One or two pilots and four passengers, in pairs in pressurised cabin; max capacity, one pilot and seven passengers. Rear-hinged door to flight deck on port side; large door for passengers and freight loading aft of wing on port side; emergency exit on starboard side above wing; provision for rapid change to cargo/passenger, freight or ambulance configuration.

SYSTEMS: Hydraulic system for landing gear and flaps. Pressurisation system maintains cabin altitude of 2,400 m (7,880 ft). Pneumatic de-icing of wing, tailplane and fin leading-edges; electric anti-icing of propeller, pilot tubes and windscreen clear-view panel. Electrical system, 27 V DC, supplied by 250SG125Q1 starter/generator and 115 A/400 Hz single-phase secondary supply with Varta 24 V emergency battery.

AVIONICS: Russian or Western equipment for single-pilot VFR or two-pilot IFR.

Comms: Bendix/King KX 165 nav/com.
Flight: Bendix/King KLN 89B GPS, WX-900 Stormscope and autopilot all optional.

DIMENSIONS, EXTERNAL:	
Wing span	13.00 m (42 ft 8 in)
Length overall	9.975 m (32 ft 8¾ in)
Height overall	3.45 m (11 ft 3¾ in)
Tailplane span	4.32 m (14 ft 2 in)
Wheel track	3.00 m (9 ft 10 in)

NAPO

**GOSUDARSTVENNOYE UNITARNOYE PREDPRIYATIE
NOVOSIBIRSKOYE AVIATIONNOYE-PROIZVODST-VENNOYE
OBEDINENIE IMENI V P CHKALOVA
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MARKETING DIRECTOR: Evgeniy A Elgaev

OSKBES MAI

**OTRASLEVOYE SPETSIALNOYE KONSTRUKTORSKOYE BYURO
EKSPERIMENTALNOGO SAMOLOTSTROENIYA,
MOSKOVSKOGO AVIATIONNOGO INSTITUTA
(SPECIAL DESIGN SECTOR BUREAU OF EXPERIMENTAL
AIRCRAFT CONSTRUCTION, MOSCOW AVIATION INSTITUTE)**

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CHIEF DESIGNER: Nikolai P Goryunov

MAI founded 1930 and immediately began aircraft design and construction. Current design bureau formed by students in 1967 and was engaged in creation of piloted and unmanned light aircraft, which were developed according to requirements of various subsidiaries of the Ministries of Aviation Industry, Civil Aviation and Defence. By official decree of 11 August 1982, the Design Bureau was transformed into an experimental students' aircraft construction design bureau of MAI, although with a full-time engineering staff, to which students and lecturers were attached as required. By late 1980s, six experimental types had been built, comprising MAI-920 glider, Kvant aerobatic lightplane Photon research jet, PS-01 Komar and Elf-D UAVs and Elf and Junior lightplanes. Additionally the company has built the gondola, controls and tail for the RosAeroSystems Au-12M airship.

During late 1980s turned to aircraft production, first with Photon design association and later the Aviatika joint-stock company. As part of the Aviatika joint stock company, the MAI Design Bureau (OB) received the name of a 'Low-Sized Aircraft Experimental Design Bureau' (OKB MA). MAI Development Plant and MAPO (Moscow Aircraft Production Organisation) were used as an industrial base. Application to Avia Register and Air Industry Department of the Ministry of Industry of Russian Federation on 27 July 1992 resulted in award on 17 February 1993 of certificate N2R9 for the rights to develop civil aircraft.

Basis for the Aviatika aircraft manufacture at MAPO (now RSK 'MiG') plant is licence agreement of 10 April 1995. Following name change to Aviatika, new light aircraft certificate (NQ P-9A) issued on 20 April 1994. During 1994–1995, OSKBES MAI (OKB MA) developed a technical offer for a light six-seat business aircraft designated Aviatika-950. In

Wheelbase	2.885 m (9 ft 5½ in)
Propeller diameter	2.30 m (7 ft 6½ in)
Passenger/freight door: Height	1.15 m (3 ft 9¼ in)
Width	1.23 m (4 ft 0½ in)
Flight deck door: Max width	0.90 m (2 ft 11½ in)
Max height	0.975 m (3 ft 2½ in)
Emergency exit: Max width	0.485 m (1 ft 7 in)
Max height	0.665 m (2 ft 2¼ in)
DIMENSIONS, INTERNAL:	
Cabin: Length	4.56 m (14 ft 11½ in)
Max width	1.32 m (4 ft 4 in)
Max height	1.26 m (4 ft 1½ in)
Volume	7.5 m ³ (265 cu ft)
AREAS:	
Wings, gross	17.06 m ² (183.6 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	2,190 kg (4,828 lb)
Max payload	540 kg (1,190 lb)
Max fuel weight	450 kg (992 lb)
T-O weight: normal	2,900 kg (6,393 lb)
max	3,270 kg (7,209 lb)
Max landing weight	3,160 kg (6,966 lb)
Max wing loading	191.7 kg/m ² (39.26 lb/sq ft)
Max power loading	5.84 kg/kW (9.59 lb/shp)
PERFORMANCE:	
Max cruising speed	210 kt (390 km/h; 242 mph)
Stalling speed, flaps down, MLW	71 kt (130 km/h; 81 mph)
Cruising altitude	7,600 m (24,940 ft)
T-O run	460 m (1,510 ft)
Landing run	390 m (1,280 ft)
Range:	
with max fuel, 45 min reserves	594 n miles (1,100 km; 683 miles)
ferry	701 n miles (1,300 km; 807 miles)

Founded in 1931 as GAZ 153, NAPO has built about 36,000 aircraft of many types, including I-16, LaGG-3, Yak-7, Yak-9, MiG-15, MiG-17, MiG-19, Yak-28, Su-9, Su-15 and, from 1972, Su-24 multirole combat aircraft. The plant is wholly state-owned, but 74.5 per cent of shares are to be transferred to Sukhoi Aviation Holding Company. NAPO's current products include the Antonov An-38 (available with local TVD-20 engines from 2002) and Sukhoi Su-34 (Su-27IB/Su-32) as well as motor boats. Built total of six An-38s. Also operates civil aerodrome at Eltsovka and NAPO Airlines; provides An-38 after-sales support. Is promoting Su-24 modernisation programmes for export customers. Was designated to build Su-49 abandoned piston trainer and was nominated in March 2003 to produce the Sukhoi Russian Regional Jet, beginning in 2006.

early 1996, Aviatika JSC changed its business plan and dispensed with services of OSKBES (to the OSKBES (OKB MA)), although latter continued work with MAPO.

Aviatika transferred all aircraft design, engineering and intellectual rights to the Moscow State Aviation Institute (MAI) under Contract N9 13/39 of 19 February 1998 and an additional agreement, N2 1-13/39 dated 3 April 1998. Subsequently, OSKBES MAI transferred manufacturing license for Aviatika series aircraft to MAPO. Has now designed aircraft or subvariants; more than 300 of MAI-890 built.

In 2006, the company announced that the MAI-217 project had been cancelled in favour of the MAI-208, no details of which have been released.

MAI-205

TYPE: Single-seat autogyro ultralight.
PROGRAMME: Prototype completed 1994; designated Aviatika-MAI-890A and powered by a 47.8 kW (64.1 hp) Rotax 582 UL. Developed MAI-205 (marked only as '205') first flew 26 January 2001. Flight testing was continuing in 2003 at Khodinka, Moscow, but by early 2006 the programme was suspended while the company concentrated on the MAI-208.

MAI-217

TYPE: Two-seat lightplane.
PROGRAMME: Development under way at OSKBES by 2000. Promotion continuing in 2003, using heavily modified MAI-910. However, the programme was cancelled without aircraft being built.

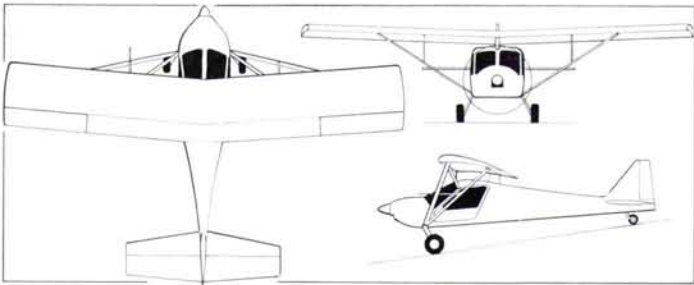
MAI-223 KITYONOK

English name: Whale Calf
TYPE: Side-by-side ultralight/kitbuilt.
PROGRAMME: Construction of prototype (serial 0101) began in 2002 and first flight achieved 20 October 2004. Flight testing on wheels, skis and floats was completed in summer 2005. Two further prototypes being built by MAI (0102) and Ural Civil Aviation Plant (PRAD) in Ekaterinburg (0103); these were nearly complete by mid-2006. In February 2006, prototype returned to factory for modification to MAI-223SKh cropspraying standard; flight testing in this guise then planned from May 2006.

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Aviatika-MAI-223 Kityonok exhibited at MAKS '05 (Yefim Gordon) 1129027



Aviatika-MAI-223 side-by-side ultralight as originally conceived with straight belly lines 0558326

CURRENT VERSIONS: **MAI-223:** Basic version, *as described*.
MAI-223SKh: Crop-spraying version, under development.
CUSTOMERS: First batch of 10 aircraft under construction by MAI and second batch of 10 being built by PRAD during 2006.
COSTS: Kit EUR16,200, excluding engine, EUR25,200 with Rotax 582, EUR32,200 with Rotax 912 ULS. Flyaway EUR34,220 with Rotax 582, EUR40,920 with Rotax 912 ULS. MAI-223SKh EUR47,860 (all 2006).
DESIGN FEATURES: Intended to conform to JAR-VLA regulations. Constant-chord, V-strut braced parasol wing is forward-swept at approximately 4°, and can be folded for storage and transportation.
DFS aerofoil, dihedral 3°, incidence 3°.
FLYING CONTROLS: Conventional and manual. Electrically operated trim tab and flaps; ground-adjustable rudder tab.
STRUCTURE: First prototype has aluminium fuselage frame with glass fibre cockpit fairing and fabric-covered tailboom. All other aircraft have glass fibre skin throughout. Two-spar wing has glass fibre skin and aluminium alloy ribs. Fabric-covered aluminium alloy control surfaces.
LANDING GEAR: Tailwheel type; fixed. Sweptback cantilever mainwheel leg attached to a torsion bar; castoring tailwheel. Hydraulic disc brakes. Mainwheel tyre size 15 × 6.00. Optionally, floats can be fitted.
POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS2 flat-four driving a ground-adjustable three-blade propeller. Alternatively, a 37.0 kW (49.6 hp) Rotax 503 UL or 47.8 kW (64.1 hp) Rotax 582 UL can be fitted. Fuel capacity 60 litres (15.9 US gallons; 13.2 Imp gallons).
SYSTEMS: 26 Ah GP 12260 battery; electrical items with total power consumption of 250W. 12V can be fitted.
DIMENSIONS, EXTERNAL:
Wing span 8.19 m (26 ft 10½ in)
Width, wing folded 3.20 m (10 ft 6 in)
Length overall 6.00 m (19 ft 8¼ in)
Height overall 2.10 m (6 ft 10¾ in)
AREAS:
Wings, gross 11.40 m² (122.7 sq ft)
WEIGHTS AND LOADINGS:
Weight empty 305 kg (672 lb)
Max fuel weight 40 kg (88 lb)
Max T-O weight: UL 495 kg (1,091 lb)
JAR VLA 600 kg (1,322 lb)
PERFORMANCE (estimated, Rotax 912 ULS):
Max operating speed 105 kt (195 km/h; 121 mph)
Normal cruising speed 97 kt (180 km/h; 112 mph)
Stalling speed, flaps down 36 kt (65 km/h; 41 mph)
Max rate of climb at S/L 360 m (1,181 ft)
T-O run 80 m (263 ft)
Landing run 65 m (214 ft)
Range, with max fuel 367 n miles (680 km; 422 miles)

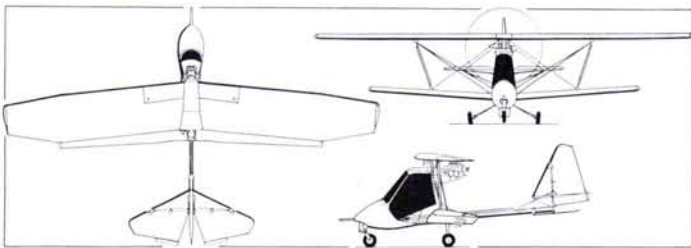
AVIATIKA-MAI-890

TYPE: Single-seat ultralight biplane; side-by-side ultralight biplane.
PROGRAMME: Open cockpit Yuniar (Junior) first flew July 1987 as single-seater with 5.68 m (18 ft 7½ in) span and 280 kg (617 lb) MTOW. Developed as MAI-89, 1989, span 8.11 m (26 ft 7½ in); MTOW 340 kg (750 lb). Production version, MAI-890, flew 1990 and entered series manufacture in 1991; although this halted temporarily in mid-1990s, it was announced in 2002 that production would continue. Russian certification awarded in December 1999. Manufactured by RSK 'MiG'.
CURRENT VERSIONS: **Aviatika-MAI-890:** Single-seater.
Aviatika-MAI-890U: Side-by-side two-seater (*uchebny*: training). First flown August 1991 (47.8 kW; 64.1 hp Rotax 582 UL). Normally with Rotax 912 UL engine (first flight 16 September 1992). Empty weight 298 kg (657 lb); MTOW 540 kg (1,190 lb); length 5.49 m (18 ft 0¼ in). Floatplane version completed trials on Lake Shartash, Ekaterinburg, September 2000. Certification agreement reported to be nearly complete in June 2004; with estimated final certification date of end 2005.
Aviatika-MAI-890SKh: Single-seat crop-sprayer version (*selskokhozyaistvenny*: agricultural); Rotax 912 ULS engine; marketing name **Farmer**. Chemical tank under engine



Aviatika-MAI-890U two-seat ultralight 0593277

and spraybar aft of lower wings; weight of agricultural equipment 28 kg (62 lb); chemicals 60 kg (132 lb) (105 litres; 27.7 US gallons; 23.1 Imp gallons) maximum with Rotax 582 engine.
Certified version received Avia Register approval on 26 April 2002. Changes include conformal chemical tank, enhanced spraying equipment, ventilated cockpit with filter, stall warner, reinforced landing gear, improved fuel system and FLYdat engine instrument system.
Aviatika-MAI-890USKh: Two-seat crop-sprayer version based on MAI-890U. Tank volume 100 litres (26.4 US gallons; 22.0 Imp gallons).
Aviatika-MAI-890S: Rotax 912 ULS 73.5 kW (98.6 hp) flat-four. Prototype (ZU-BZO) converted in South Africa, 1999, by Aeroserve Pty Ltd. Regarded by OSKBES as standard 890.
CUSTOMERS: More than 300 delivered by March 2006, of which some 60 were agricultural variants; eight sold during last six months of 2001, including six equipped for crop spraying. Approximately 30 imported by a South African dealer in 1995; these known locally as **890CSH Mai** and **890U Mai**. Total market for agricultural variant estimated at 800 to 1,000.
COSTS: MAI-890 with Rotax 503 UL EUR17,410, Rotax 582 UL EUR19,470; MAI-890 SKh EUR32,450, with JAR-VLA certification EUR37,050; MAI-890U with Rotax 912ULS EUR32,150; MAI-890USKh with Rotax 912ULS EUR38,450 (2005).
DESIGN FEATURES: Strut- and wire-braced biplane; unspinnable; conventional tail surfaces carried on tubular boom; engine mounted under trailing-edge of upper wing; slight sweepback on all wings; dihedral on lower wings only. Semi-aerobatic and capable of flying in rough air conditions. Designed to JAR-VLA and FAR Pt 23 standards. Two cockpit doors, one jettisonable; provision for backpack parachute(s).
FLYING CONTROLS: Conventional and manual. Full-span ailerons on lower wings; large-area rudder and elevators, each with ground-adjustable tab.
STRUCTURE: Aircraft grade aluminium and titanium alloys, alloy steels; fabric covering unaffected by sun's radiation or atmospheric precipitation.
LANDING GEAR: Tricycle type; fixed. Twin cantilever mainwheel legs attached to main boom to rear of cabin; single wheel on each unit. Brakes on mainwheels. Optional skis or floats. All wheels 300×125.
POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS four-cylinder piston engine; VV-98E-11 two-blade pusher propeller. A 37.0 kW (49.6 hp) Rotax 503 UL-2V may also be fitted. Standard fuel 50 litres (13.2 US gallons; 11.0 Imp gallons); provision for 55 litre (14.5 US gallon; 12.1 Imp gallon) auxiliary tank on single-seat version.
EQUIPMENT: Provision for up to 120 kg (265 lb) payload on four attachments, under engine mountings (60 kg; 132 lb), or underbelly (100 kg; 220 lb), or at lower wingtips (each 45 kg; 99 lb), including agricultural dusting and spraygear for Aviatika-MAI-890USKh Farmer. Optional BRS ballistic parachute system.
Following details apply to certified 890SKh with Rotax 912 ULS engine.
DIMENSIONS, EXTERNAL:
Wing span, upper 8.11 m (26 ft 7½ in)
Length overall, incl pitot 5.32 m (17 ft 5½ in)
Height to tip of fin 2.25 m (7 ft 4½ in)
AREAS:
Wings, gross 14.29 m² (153.8 sq ft)
WEIGHTS AND LOADINGS:
Weight empty 331 kg (730 lb)
Max T-O weight 540 kg (1,190 lb)
PERFORMANCE:
Max level speed 70 kt (130 km/h; 81 mph)
Cruising speed 49 kt (90 km/h; 60 mph)
Landing speed 41 kt (75 km/h; 47 mph)
Max rate of climb at S/L 159 m (522 ft)/min
T-O run 90 m (295 ft)
Landing run 130 m (430 ft)
Endurance 2 h 53 min
g limits +5/-2.5



Aviatika-MAI-890 (Rotax piston engine) (Paul Jackson) 0051198

AVIATIKA-MAI-910 INTERFLY

TYPE: Two-seat lightplane.

PROGRAMME: Design started and construction of first prototype began 1993; first flight 22 June 1995 in MAI-910 configuration. Promotion began at MAKS '99, Moscow, August 1999; by early 2006, flight testing had been completed.

Original version had boom-mounted empennage. Boom subsequently covered with removable fairings, for more conventional appearance, and ventral strake added.

DESIGN FEATURES: Designed to JAR-VLA standards. Braced high-wing monoplane; single bracing strut and jury strut each side; fully enclosed cabin pod; strut- and wire-braced conventional tail unit carried on interchangeable rear fuselage of conventional thickness or on short boom. Wings fold.

Wing section CAHI (TsAGI) Sh-1-14; 1° leading-edge sweepback; thickness/chord ratio 14 per cent; constant chord except for tapered tips; no dihedral; incidence 5°.

FLYING CONTROLS: Conventional and manual. Actuation by cables; long-span flap on each wing; ground-adjustable tab on rudder and each elevator.

STRUCTURE: Metal structure with fabric-covered wings and tail surfaces, metal-skinned fuselage. Wings have single tubular spar, diameter 102 mm (4 in), and stamped sheet metal ribs. Materials primarily aluminium alloy, with stainless steel and titanium alloy where appropriate.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted, spring cantilever mainwheel legs; trailing-link nosewheel. Mainwheel tyres 400x150 or 300x120; nosewheel tyre 300x120; tyre pressure (all) 2.53 bar (37 lb/sq in). Mechanical brakes with 300x120 tyres; hydraulic brakes with 400x150 tyres. Nosewheel steerable through ±50°. Tailwheel gear optional.

POWER PLANT: One 59.6 kW (79.9 hp) Rotax 912 UL flat-four; Russian two-blade fixed-pitch propeller. Two fuel tanks, each 25 litres (6.6 US gallons; 5.5 Imp gallons); one in each wingroot. Oil capacity 6 litres (1.6 US gallons; 1.3 Imp gallons).

ACCOMMODATION: Two seats side by side in fully enclosed cabin with wide field of view for observation, patrol, search and aerial photography. Passenger seat folds for carriage of stretcher or lengthy freight. Large rearward-sliding window/door each side. Space for baggage or freight behind seats. Cabin heated and ventilated.

SYSTEMS: 12 V AC electrical system; Teledyne battery.

AVIONICS: Comms: UHF radio.

Flight: GPS.

DIMENSIONS, EXTERNAL:

Wing span	10.73 m (35 ft 2½ in)
Wing chord: at root	1.10 m (3 ft 7¼ in)
at tip	0.70 m (2 ft 3½ in)
Wing aspect ratio	10.3



Aviatika-MAI-910 with original rear fuselage (James Goulding)

0011968



Aviatika-MAI-910 light passenger/freight aircraft, showing new rear fuselage

0593291

Length overall	5.26 m (17 ft 3 in)
Height overall	2.50 m (8 ft 2½ in)
Wheel track	2.20 m (7 ft 2¾ in)
Wheelbase	1.60 m (5 ft 3 in)
Propeller diameter	1.90 m (6 ft 2¾ in)
Propeller ground clearance	0.30 m (11¾ in)
Doors (each): Height	0.87 m (2 ft 10¼ in)
Max width	1.10 m (3 ft 7¼ in)
Baggage door: Length	0.75 m (2 ft 5½ in)
Width	0.70 m (2 ft 3½ in)

DIMENSIONS, INTERNAL:

Cabin: Max width	1.20 m (3 ft 11¼ in)
Max height	1.08 m (3 ft 6½ in)
Floor area	1.20 m² (12.9 sq ft)
Baggage/freight volume	0.70 m³ (24.7 cu ft)

AREAS:

Wings, gross	11.20 m² (120.6 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	380 kg (838 lb)
Max fuel	40 kg (88 lb)
Max T-O weight	620 kg (1,366 lb)
Max wing loading	55.4 kg/m² (11.34 lb/sq ft)
Max power loading	10.40 kg/kW (17.09 lb/hp)

PERFORMANCE:

Never-exceed speed (VNE)	121 kt (225 km/h; 139 mph)
Max level speed at S/L	84 kt (155 km/h; 96 mph)
Max and econ cruising speed	75 kt (140 km/h; 87 mph)
Stalling speed	41 kt (76 km/h; 48 mph)
Max rate of climb at S/L	210 m (690 ft)/min
Service ceiling	3,000 m (9,840 ft)
T-O run	150 m (495 ft)
T-O to 15 m (50 ft)	300 m (985 ft)
Landing from 15 m (50 ft)	150 m (495 ft)
Range	216 n miles (400 km; 248 miles)
g limits	+4/-2

POLYOT

PROIZVODSTVENNOYE OBDINENIE POLET (POLYOT PRODUCTION ASSOCIATION)

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Web: www.polyot.omsk.ru

GENERAL DIRECTOR: Valentin Ziatsev



Antonov An-3 converted by Polyot

1128965

DESIGN BUREAU:

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Fax: (+7 3812) 53 88 31

CHIEF DESIGNER: Viktor V Markelov

Established in 1941, Polyot is one of the largest aerospace enterprises in Russia, with facilities extending over more than 15 km² (5.8 sq miles) and up to 20,000 employees. During the Second World War it manufactured 3,405 Tupolev Tu-2 bombers and Yakovlev Yak-7 and Yak-9 fighters in 2½ years; post-war products included 758 Ilyushin Il-28 jet bombers and 58 Tupolev Tu-104 jet transports. It remains state-owned. The Antonov An-74 series of STOL transports is in low-rate production.

Polyot manufactured SS-4, SS-7 and SS-11 strategic missiles, warheads, and first-stage engines for Zenith and Energiya rocket launch vehicles. Other products include Kosmos rocket, spacecraft and wind turbines and a variety of consumer goods under *konversiya* programmes.

In June 1997, Polyot and Baranov Engine Manufacturing Association relaunched the Antonov An-3 programme (An-2 with 1,140 kW; 1,529 shp OMKB TVD-20 turboprop). Certification of factory to build An-3 received by May 2000, but funding unavailable for production line and only conversions of An-2s being considered. By mid-2003, An-3s were serving in seven companies and Polet expected to sell its annual allocation of 10, increasing this to 15 in 2004. Cost is US\$800,000 to US\$900,000. An-3 work was interrupted during the first half of 2001 when Polyot repaired the prototype Antonov An-70 after it had crashed following take-off from Omsk. Revealed in September 2001 that Polyot selected to assemble An-70s ordered for Russian Air Forces; first An-70 originally intended to fly in 2003. Required investment to begin An-70 production (Polyot to build cargo hold) quoted in late 2001 as Rb3 billion, of which Russian government and Omsk regional government each donating Rb1,050 million.

In May 2002, Polyot revealed its recent work on the Yula 'strap-on' personal helicopter, although little further has been heard of the proposal.

RAA

RUSSIAN AMERICAN AVIATION DESIGN GROUP

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Aleksandr M Gorbunov

A diverse range of new and (mostly) established aircraft designs is offered for production by RAA, including the Aeroprogress T-101 Grach (deputy designer A V Andreyev); Khru'nichev T-411 Aist and T-415; Thurston TA-16 (most recently offered in US as Aquastar Seafire); and Ivolga and VVA-14 wing-in-ground-effect craft. Research is continuing into a 2,000-tonne ekranoplan, 24-seat airliner and a training aircraft. The Voyager E-7 was first offered in the US in 2006.

RAA VOYAGER E-7 BUSHPLANE

TYPE: Light utility transport.
PROGRAMME: Incomplete fuselage exhibited at AirVenture, Oshkosh, July 2006; seeking partners to launch production.
CURRENT VERSIONS: **Model 300:** Baseline version; tailwheel; 224 kW (300 hp) Textron Lycoming IO-540 piston engine and short (11.73 m; 38 ft 5¾ in) wing span, MTOW 2,200 kg (4,850 lb); range 1,133 n miles (2,100 km; 1,304 miles) with 30 min reserves.
Model 400: As described.
Model 750 Turbo: With 559 kW (750 shp) Pratt & Whitney Canada PT6A turboprop. Otherwise generally as Model 400, except all-metal wing and eight fuel tanks, combined capacity 800 litres (211 US gallons; 176 Imp gallons); max level speed 170 kt (315 km/h; 196 mph); range 809 n miles (1,500 km; 932 miles); MTOW 2,700 kg (5,952 lb).
DESIGN FEATURES: Modelled on capabilities of DHC-2 Beaver. High, constant-chord, strut-braced wing; low, constant-chord tailplane; sweptback fin with small fillet. Landing gear, engine and wing area options.
FLYING CONTROLS: Conventional and manual.
STRUCTURE: Generally of metal, but fabric-covered wing (except metal for Model 750).
LANDING GEAR: Tricycle type; fixed. Telescopic mainwheel legs hinged to lower sides of fuselage and braced to centreline by V-type radius arms. Cantilever, trailing link nose unit. Model 300 has tailwheel and main leg attachments further forward. Optional floats and skis.
POWER PLANT: One 298 kW (400 hp) Textron Lycoming IO-720 piston engine. Fuel in six tanks, total capacity 432 litres (114 US gallons; 95.0 Imp gallons).
ACCOMMODATION: Seven persons, including one or two pilots. Two doors each side, separated by central window. Forward doors totally transparent.
Data follow for Model 400.
DIMENSIONS, EXTERNAL:
Wing span 13.575 m (44 ft 6½ in)
Wing aspect ratio 7.4
Length overall 11.075 m (36 ft 4 in)
Height overall 3.885 m (12 ft 9 in)
DIMENSIONS, INTERNAL:
Cabin: Length 3.56 m (11 ft 8¼ in)
Max width 1.38 m (4 ft 6¼ in)
Max height 1.55 m (5 ft 1 in)
AREAS:
Wings, gross 24.80 m² (266.9 sq ft)
WEIGHTS AND LOADINGS:
Max T-O weight 2,300 kg (5,070 lb)
Max wing loading 92.7 kg/m² (18.99 lb/sq ft)
Max power loading 7.71 kg/kW (12.68 lb/hp)
PERFORMANCE:
Max level speed 135 kt (250 km/h; 155 mph)
Stalling speed, flaps down 38 kt (70 km/h; 44 mph)
T-O run 48 m (160 ft)



Fuselage of prototype RAA Voyager E-7 Bushplane 1158661



Cutaway of RAA Voyager E-7 Bushplane 1158662

T-O to 15 m (50 ft)	135 m (445 ft)
Landing from 15 m (50 ft)	162 m (535 ft)
Landing run	42 m (140 ft)
Range with 30 min reserves	1,133 n miles (2,100 km; 1,304 miles)

RIDA

PKB RIDA ANO

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CHAIRMAN: Aleksey Ivanter

Rida design bureau established in 1989 and designed the P10 Ptenets lightplane; produced a prototype of the Pony two-seat amphibian; and planned a four-seat derivative, the Prize. More recently, two new programmes have been announced: the Aleks-251 and a larger, Proect 256 (Project 256). Neither appears to have made progress in recent years.

RIDA ALEKS-251

TYPE: Six-seat amphibian.
PROGRAMME: Announced 2003, when first flight planned in second half of 2004; this, apparently, did not take place and the programme remained unfruitful, but still active, in early 2006. Reportedly developed for an undisclosed Russian Federation ministry, which has a requirement for up to 800.

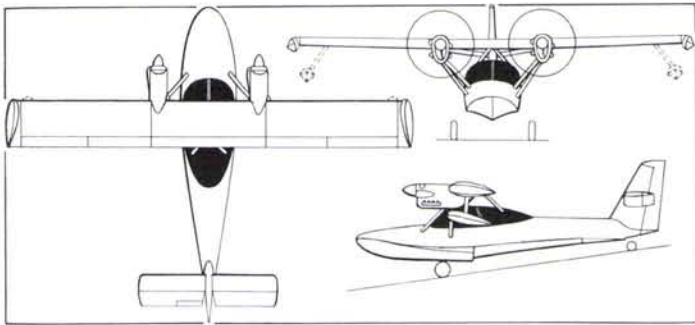
DESIGN FEATURES: Parasol wing amphibian with single-step hull; cruciform empennage with sweptback fin. Constant-chord wing and tailplane; outrigger floats retract to form wingtips when not in use. Operable on water with wave height of 0.45 m (1 ft 6 in).
FLYING CONTROLS: Conventional and manual. Horn-balanced rudder. Flaps.
LANDING GEAR: Optional tricycle type.
POWER PLANT: Two LOM M332S four-cylinder engines, each 127 kW (170 hp), projecting forward from undersides of wing. Fuel tanks in wings; total capacity 800 litres (211 US gallons; 176 Imp gallons).
ACCOMMODATION: Pilot and five passengers; six passengers at maximum capacity. Port, centre transparency removable for access to cabin; windscreen split along centreline and hinged at base, both sides, to ease access for pilot(s).
EQUIPMENT: MVEN ballistic recovery parachute.

DIMENSIONS, EXTERNAL:

Wing span	13.20 m (43 ft 3¾ in)
Wing chord, constant	1.50 m (4 ft 11 in)
Wing aspect ratio	8.8
Length overall	10.54 m (34 ft 7 in)
Height, wheels retracted	3.10 m (10 ft 2 in)



Artists's impression of Rida Aleks-251 0583657



Rida Aleks-251 six-seat amphibian (James Goulding) 1151698

Tailplane span	4.15 m (13 ft 7½ in)
Wheel track (optional)	2.35 m (7 ft 8½ in)
Wheelbase (optional)	6.25 m (20 ft 6 in)
Propeller diameter	1.855 m (6 ft 1 in)
Distance between propeller centres	3.00 m (9 ft 10 in)
DIMENSIONS, INTERNAL:	
Cabin: Length	3.10 m (10 ft 2 in)
Max width	1.40 m (4 ft 7 in)
Max height	1.30 m (4 ft 3¼ in)
AREAS:	
Wings, gross	19.80 m ² (21.31 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	1,360 kg (2,998 lb)
Max payload	600 kg (1,323 lb)
Max T-O weight	2,100 kg (4,629 lb)
Max wing loading	106.1 kg/m ² (21.72 lb/sq ft)
Max power loading	8.29 kg/kW (13.61 lb/hp)
PERFORMANCE:	
Max level speed	127 kt (235 km/h; 146 mph)
Normal cruising speed at FL98	113 kt (210 km/h; 130 mph)
Econ cruising speed at FL98	97 kt (180 km/h; 112 mph)
Unstick speed	59 kt (110 km/h; 68 mph)
Stalling speed: clean	62 kt (114 km/h; 71 mph)
flaps and gear down	52 kt (96 km/h; 60 mph)
Max rate of climb at S/L	300 m (984 ft)/min
T-O run: land	300 m (985 ft)
water	470 m (1,545 m)
Landing run: land	300 m (985 ft)
water	280 m (920 m)
Range with 500 kg (1,102 lb) payload: at normal cruising speed	399 n miles (1,740 km; 459 miles)

at econ cruising speed	1,512 n miles (950 km; 590 miles)
ferry	1,943 n miles (3,600 km; 2,236 miles)
Endurance	20 h

RIDA 256

TYPE: Utility amphibian.

PROGRAMME: Reported by 2003 to be under development for Australian Coast Guard; first flight intended in late 2005 or early 2006; backing from Australian investors. No further details revealed up to early 2006; no evidence of manufacturing having begun.

DESIGN FEATURES: Twin-prop amphibian with high-mounted, high aspect ratio, strut-braced, constant-chord wing and sweptback fin with ventral fillet. Boat hull with main and rear steps; convex flare. Fixed outrigger floats at approx 75 per cent of span. Engines mounted above wings. Meets AP-23 certification requirements. Operable in wave heights up to 0.75 m (2 ft 6 in).

FLYING CONTROLS: Conventional and manual.

LANDING GEAR: Tricycle type; retractable.

POWER PLANT: Two Walter M 601 turboprops, each 560 kW (751 shp).

ACCOMMODATION: Two pilots and 19 passengers, with baggage area at rear. Seats three abreast (two plus one, with offset aisle), fifth row between mainwheel bays comprising single seat. Max nine passengers under AP-23 rules. Two-element, horizontally divided freight door, port, rear.

DIMENSIONS, EXTERNAL:

Wing span	18.80 m (61 ft 8¼ in)
Length overall	14.70 m (48 ft 2¾ in)
Max width of fuselage	1.91 m (6 ft 3¼ in)
Freight door: Height	1.41 m (4 ft 7½ in)
Width	1.40 m (4 ft 7 in)

DIMENSIONS, INTERNAL:

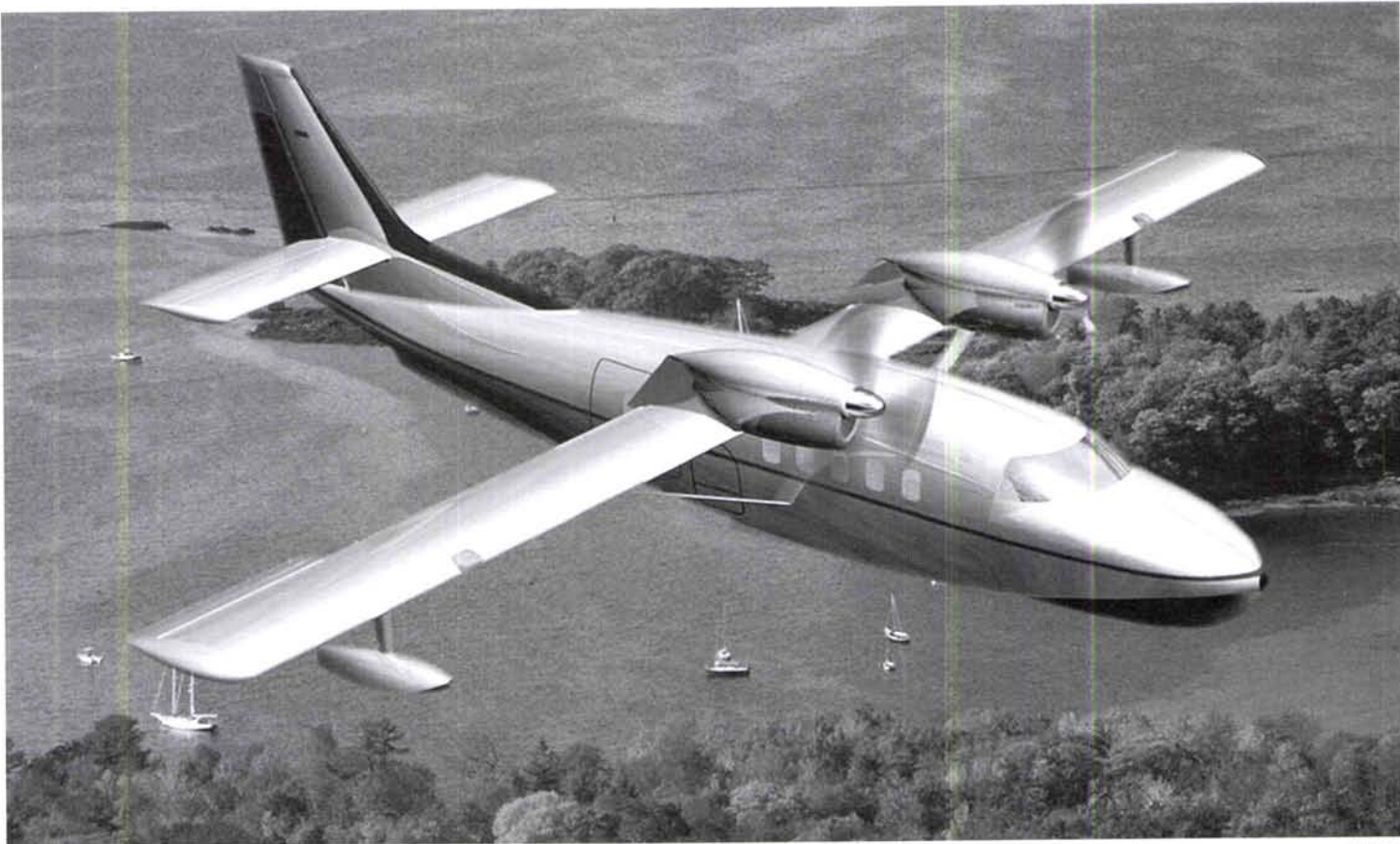
Cabin (between bulkheads): Length: overall	8.58 m (28 ft 1¾ in)
passenger area	5.88 m (19 ft 3½ in)
Max width	1.80 m (5 ft 10¾ in)
Max height	1.88 m (6 ft 2 in)

WEIGHTS AND LOADINGS:

Weight empty	3,700 kg (8,157 lb)
Max T-O weight	5,700 kg (12,566 lb)
Max power loading	5.09 kg/kW (8.37 lb/shp)

PERFORMANCE:

Max level speed	243 kt (450 km/h; 280 mph)
Econ cruising speed	211 kt (390 km/h; 242 mph)
Unstick speed	76 kt (140 km/h; 87 mph)
Max rate of climb at S/L	540 m (1,772 ft)/min
Cruising altitude	9,000 m (29,520 ft)
T-O run: on land	480 m (1,575 ft)
on water	580 m (1,905 ft)
T-O to 15 m (50 ft) on land	800 m (2,625 ft)
Range: with max fuel	2,159 n miles (4,000 km; 2,485 miles)
with 1,600 kg (3,527 lb) payload	270 n miles (500 km; 310 miles)



Artist's impression of Rida 256 amphibian

0583656

ROSAEROSYSTEMS

ROSAEROSYSTEMS S.R.A
(DIVISION OF AUGUR AERONAUTICAL CENTRE)

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Web: www.rosaerosystems.pbo.ru
CHAIRMAN: Gennady Verba

RosAeroSystems was formed in October 1997 by Avgur, Moscow Aviation Institute and the Russian Aeronautical Society (RVO) as a consortium to combine the efforts of lighter than air manufacturing and operation. Other partners within Russia now include Lavochkin OKB, Babakin Space Centre, Moscow Aviation Institute and CAHI (TsAGI). Foreign partners include Kubicek (Czech Republic), Voliris (France), and the US companies Worldwide Aeros and General Aeronautics Corporation. It offers a wide range of manned and unmanned airships and other aerostats under current design; any manufacture of these would be undertaken by Avgur, with whom it is co-located, or other Russian aviation companies, although RosAeroSystems has its own envelope production unit within its 5,000 m² (53,825 sq ft) facility and can produce and test envelopes of up to 50,000 m³ (1.76 million cu ft) size. Its latest product is an 18-passenger, tethered spherical aerostat named AeroLift, which received domestic certification to FAR Pt 31 standard in July 2002 and EASA certification on 10 June 2005. RosAeroSystems' workforce totalled more than 50 in 2001. RosAeroSystems International Ltd was formed as a US marketing organisation in 2002.

ROSAEROSYSTEMS Au-11

TYPE: Helium non-rigid airship.
PROGRAMME: Construction (by Avgur) began January 1997. Planned to fly in September 1998, but delayed; eventually made first flight August 2001. On 10 February 2005, an Au-11 (RF-000034R) piloted by Leonid Putintsev established at Zhukovsky (Ramenskoye) a Class BA-02 FAI speed record of 27.0 kt (50.0 km/h; 31.1 mph).
CUSTOMERS: One acquired by Moscow traffic police in 2004 as crew trainer for Au-12. No other production known.
Description as for Au-12 except as follows.
DESIGN FEATURES: Single-seat version of Au-12; otherwise generally differs only in dimensions, power plant, gondola and range/endurance performance.
POWER PLANT: One 20.9 kW (28 hp) VAZ-1111 motorcar engine and two-blade ducted propeller; 15° up/90° down thrust vectoring; 2.5 kW (3.4 hp) stern thruster engine and auxiliary fuel tank as in Au-12.
ACCOMMODATION: Pilot only. Upward-opening door on port side of gondola. Two to four ground crew.
DIMENSIONS, EXTERNAL:
Envelope: Length 27.50 m (90 ft 2¾ in)
Max diameter 6.875 m (22 ft 6¾ in)
Fineness ratio 4.0
Height overall 9.40 m (30 ft 10 in)
DIMENSIONS, INTERNAL:
Envelope volume 669.0 m³ (23,626 cu ft)
Ballonet volume (max) 123.0 m³ (4,344 cu ft)
AREAS:
Tail surface area (total) 26.50 m² (285.2 sq ft)
WEIGHTS AND LOADINGS:
Weight empty 465 kg (1,025 lb)
Max payload 160 kg (353 lb)
Max T-O mass 870 kg (1,918 lb)
PERFORMANCE:
Max level speed 43 kt (80 km/h; 49 mph)
Cruising speed 32 kt (60 km/h; 37 mph)
Pressure ceiling 2,000 m (6,560 ft)
Range at cruising speed:
standard fuel 162 n miles (300 km; 186 miles)
with auxiliary fuel tank 432 n miles (800 km; 497 miles)
Endurance: at max speed 2 h 30 min
at cruising speed 5 h



RosAeroSystems Au-11 non-rigid

1158645

ROSAEROSYSTEMS Au-12

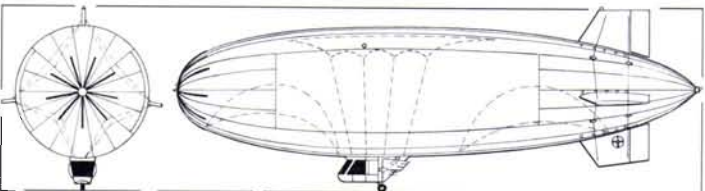
TYPE: Helium non-rigid airship.
PROGRAMME: Two-seat enlarged version of single-seat Au-11. Avgur prototype flown in 1998.
CURRENT VERSIONS: **Au-12:** As described; cruciform tailfins.
Au-12M: First displayed in 2003; suffix indicates modification to X tailfin configuration.
CUSTOMERS: Modified Au-12 envelope delivered to Voliris of France for that company's Voliris 900. Two Au-12s ordered in early 2003 by Russian Ministry of Transport and Communications for experimental traffic monitoring programme in Moscow; acceptance tests begun August 2004 and completed early 2005. Exhibited at Moscow Salon (RF-28975) August 2005. Moscow traffic patrol continued during that year, using two Au-12Ms and three Au-17 Bars tethered aerostats, with a larger Au-27 aerostat due to join fleet by end of 2005.

DESIGN FEATURES: Intended for advertising, demonstration or patrol flights with purpose-designed onboard equipment, command uplink and information downlink. Space for two advertising displays on envelope sides. Conventional envelope shape; cruciform tailfins, each with elevator or rudder. Design is compliant with Russian Federation and US FAA airship design criteria.
FLYING CONTROLS: Engine thrust vectored in vertical plane by movable louvres; combined manual/electromechanical rudder and elevator control (cables); stern thruster in lower tailfin. Two internal air ballonets.
STRUCTURE: Envelope of modern composites fabric on Laysan base, with polyurethane skin and titanium oxide UV protection. Tail surfaces have tubular frames with high-strength, stretch-wrapped fabric skins. Reinforced nose with mooring cone.
LANDING GEAR: Single non-retractable and self-centring wheel, on telescopic leg, under gondola. Provision for flotation bags.
POWER PLANT: One 64.9 kW (87 hp) Subaru 1.8 piston engine, with 30° up/105° down, five-vane cascade-type thrust vectoring, mounted on rear of gondola; 2.5 kW (3.4 hp) stern thruster electric motor and propeller mounted on port side of lower tailfin. Provision for 20 litre (5.3 US gallon; 4.4 Imp gallon) auxiliary fuel tank.
ACCOMMODATION: Pilot and one passenger in gondola. Upward-opening door on each side. Ground crew of two or three.
AVIONICS: Basic VFR or IFR instrumentation. Radio modem or satcom datalink for patrol/surveillance and other special missions.
EQUIPMENT: Depending on mission, can include such items as radiation and chemical monitoring devices; electromagnetic and heat flow gauges; TV camera with video downlink; NP-1 scientific package including photon spectrometer, radiometer, polarimeter and space navigation set; and onboard computer.
DIMENSIONS, EXTERNAL:
Envelope: Length 31.40 m (103 ft 0¼ in)
Max diameter 7.85 m (25 ft 9 in)
Fineness ratio 4.0
Height overall 11.30 m (37 ft 1 in)
Advertising panel (each side):
Length 20.00 m (65 ft 7½ in)
Depth 6.00 m (19 ft 8¼ in)
DIMENSIONS, INTERNAL:
Envelope volume 996.0 m³ (35,173 cu ft)
Ballonet volume (two, total) 250.0 m³ (8,829 cu ft)
AREAS:
Advertising area (each side) 120.0 m² (1,291.7 sq ft)
WEIGHTS AND LOADINGS:
Weight empty 620 kg (1,367 lb)
Max payload pilot + 50 kg (110 lb)
PERFORMANCE:
Max level speed 43 kt (80 km/h; 50 mph)
Cruising speed 32 kt (60 km/h; 37 mph)
Cruising altitude 1,000 m (3,280 ft)
Pressure ceiling 2,000 m (6,560 ft)
Range at cruising speed above:
standard fuel 135 n miles (250 km; 155 miles)
with auxiliary fuel tank 324 n miles (600 km; 372 miles)
Endurance: at max speed 2 h
at cruising speed above 5 h



RosAeroSystems Au-12M, showing revised tailfin positions

1158649



The Au-12 two-seat advertising airship (James Goulding)

0085412

ROSTVERTOL

ROSTOVSKY VERTOLETNYI PROIZVODSTVENNYI KOMPLEKS 'OAO 'ROSTVERTOL' ('ROSTVERTOL' ROSTOV HELICOPTER PRODUCTION COMPLEX JSC)

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DEPUTY DIRECTOR GENERAL: Igor A Semyonov

CHIEF ENGINEER: Andrey A Varfolomeyev

ACTING DEPUTY DIRECTOR GENERAL, MARKETING AND EXPORT SALES: Vadim V Barannikov

The company now known as Rostvertol was founded on 1 July 1939, and began by

manufacturing wooden propellers. It progressed to aircraft production during the Second World War and to helicopter work in the mid-1950s. Past products at Rostov-on-Don included the UT-2M (1944), Po-2, Yak-14 glider, Il-10M, Il-40, Mi-1, Mi-6, Mi-10 and Mi-10K. Rostvertol is almost completely privately owned, with a small government share.

Is world's largest heavy transport and combat helicopter manufacturer, supplying Mi-26 (largest multirole helicopter in production); modifications of Mi-24/35 'Hind', including 'PN' night-capable, cannon-armed version and 'M' upgraded version; and, since 2004, new-build Mi-28N to Russian Army Aviation, of which 50 required by 2010. Also offers Mi-2 upgrades including new engine and main rotors. Received contract in March 2005 for one Mi-26 and three Mi-35M helicopters for Venezuelan armed forces.

Government decree of 19 February 1996 authorised Rostvertol to export civil version of Mi-26. Additionally ESUE Rosoboroneksprom markets Rostvertol-built Mi-24/35s and Mi-28s. Also involved in Mi-60 project.

Company has exported 650 aircraft to more than 20 countries.

In April 2003, established Aviakompaniya 'Rostvertol' ('Rostvertol' Aviation Company) to provide helicopter airlift, firefighting and maintenance services.

RSK 'MIG'/P A VORONIN PRODUCTION CENTRE

FEDERALNOYE GOSUDARSTVENNOYE UNITARNOYE PREDPRIYATIE, ROSSIYSKAYA SAMOLETOSTROITEL'NAYA KORPORATSIYA 'MIG' (RUSSIAN AIRCRAFT-BUILDING CORPORATION 'MIG' FEDERAL STATE UNITARY ENTERPRISE)

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FIRST DEPUTY GENERAL DESIGNER: Sergey V Tsivilev

DIRECTOR, MIKOYAN DESIGN BUREAU: Vladimir I Borkovsky

DEPUTY GENERAL DIRECTOR, MARKETING AND SALES: Vladimir P Vypryazhkin

DIRECTOR FEDOTOV FLIGHT TEST CENTRE: Pavel N Vlasov

PUBLIC RELATIONS AND MEDIA CENTRE:

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HEAD OF PUBLIC RELATIONS: Elena I. Fedorova

Original Moscow Aircraft Production Organisation (MAPO) renamed by official decree of 8 December 1999 as RSK 'MiG' and its Botkinsky manufacturing plant dedicated to former director (1938-1982) Pavel A Voronin. Up to 1999, MAPO (formerly MMZ No. 30 Znamaya Truda [Banner of Labour]) had built 25,000 aircraft of 40 types, from the Nieuport IV of 1913 to the MiG-29. On 5 October 1999, it was nominated as a production centre for the Tupolev Tu-334 airliner in return for contributing 50 per cent of certification costs. By late 2003, lack of progress by the company in launching Tu-334 manufacture had prompted government consideration of alternative production centre.

By April 2006, MiG design bureau working with Klimov engine plant on I-21 lightweight fifth-generation fighter as private venture. Seen as single-engine companion to Sukhoi PAKFA; target first flight date improbably quoted as "2006-07".

Service activities include complete maintenance support and pilot training; is also involved in Chinese Chengdu FC-1 fighter programme, China.

Aircraft production is at the Voronin centre, which comprises original Botkinsky Street premises alongside the Mikoyan design complex in Moscow; at Kalyazin; and at LAPIK, Lkhovitsy. Personnel in 2003 totalled 14,500.

Members of RSK 'MiG' are:

GENERAL DIRECTORATE:

A I Mikoyan OKB (R&D engineering centre), Moscow (described separately)

P A Voronin Production Centre, comprising

LAPIK, Lkhovitsy (described separately)

Botkinsky proezd, Moscow

Kalyazin Machine-Building Plant, Kalyazin

A V Fedotov Flight Test Centre, Zhukovskiy

Aircraft Logistic Support Centre

Marketing and Sales Centre

Economic and Financial Centre

Strategic Development and Planning Centre

ENGINE-BUILDING DIVISION

V V Chernyshev Machine-Building Enterprise, Moscow

V Ya Klimov Plant, St Petersburg

Krasny Otkryabr Machine-Building Enterprise, St Petersburg

Soyuz Machine-Building Design Bureau, Tushino

INSTRUMENT-BUILDING DIVISION

Ryazan State Instrument Plant, Ryazan

Pribror JSC, Kursk

Elektroavtomatika Design Bureau, St Petersburg

HELICOPTER-BUILDING DIVISION (VERTOLETOSTROITEL'NYI DIVIZION)

Kamov JSC, Lyubertsy

CIVIL AIRCRAFT-BUILDING DIVISION (DIVIZION GRAZHDANSKOGO SAMOLETOSTROENIYA)

MiG-MGA, Moscow (MiG-Malaya Grazhdanskaya Aviatsiya)

PRODUCTS AND SERVICES DIVISION

MiG-Resurs JSC, Moscow

MiG-Rost JSC, Moscow

GROUND SERVICING AND TEST EQUIPMENT DIVISION

Aviatest JSC, Rostov-on-Don

Lapik — Lkhovitsy Aviatsionnyi Proizvodstvenno-Isptatelnyy Kompleks (Lkhovitsy Aviation Production-Testing Complex)

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Founded at Tretyakovo airfield in 1953, this state-owned subsidiary of RSK 'MiG' functioned as a flight test centre until 1968 (and continues to do so for the MiG-29). It then was assigned to Znamaya Truda production plant, replacing final assembly and test airfield at Khodinka, in the Moscow suburbs, and consequently acquired extensive equipment for manufacturing high-strength aluminium, titanium and composites components in support of RSK 'MiG' production, being renamed Lkhovitsy Mashinostroitelnyy Zavod (LMZ — Lkhovitsy Machine-Building Plant). On 7 March 1996 became first (and, currently, only) Russian factory with light aircraft production approval certificate. Assembly continues at low rate of the Aeroprogress T-101 Grach and Aviatika (OSKBES MAI) lightplanes. Manufacture of the Ilyushin Il-103 (some 40 by 2004) and Interavia I-1L continues intermittently. Also participated in manufacture of parts for Sukhoi Su-29 and Su-31 sportplanes, being responsible for complete assembly from January 2001 onwards.

Announced in June 2000 that Lkhovitsy will produce Ilyushin Il-100, Naval MiG-29Ks for India will be built at LAPIK, as will MiG-110 medium transport, despite previous allocation to Sokol.

Other activities include flying school for commercial or private pilot training on Il-103; freight handling; and production of jetskis and suntanning beds.

In 2001, construction began at Lkhovitsy of a 12,600 m² (135,625 sq ft) Tu-334 assembly hall; this was commissioned in January 2003, launching move of almost all of Voronin plant out of central Moscow. However, Tu-334 programme was dormant by 2005.

LMZ adopted current name of LAPIK by January 2002.

SAZ

SARATOVSKY AVIATION ZAVOD ZAO (SARATOV AVIATION PLANT JSC)

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Web: www.yak40.com/about.htm

Founded in 1929 as agricultural machinery manufacturer. First aircraft built at Saratov flew on 28 October 1938. During the Second World War, the Saratov plant (GAZ 292) manufactured Yakovlev Yak-1 and Yak-3 piston-engined fighters, continuing post-war with Yak-11, La-15, Yak-23, Yak-25 and Yak-27 military jet aircraft and, from May 1952, Mi-2 helicopter. In the 1960s and 1970s, production centred on the Yak-40 three-turboprop transport, with Yak-36 and Yak-141 V/STOL prototypes and Yak-38 V/STOL fighters also manufactured in the 1970s and 1980s. Yak-42 entered series production in 1982, although there have been no recent completions. Yak-54 trainer/sporting aircraft production began in 1994, but in early 2001, SAZ was unsuccessfully, as it transpired, attempting to resuscitate an American order for 48

which had previously been terminated after only six deliveries. Of five Yak-54s to have been built in 2001, only one completed before venture was abandoned for lack of funds. Restart of production conditional upon order for 25 or more. Yak-56 primary trainer is also earmarked for production at SAZ, as are Yak-142, Yak-242 (since displaced in Yakovlev's plans by the MS-21 airliner) and Moukamedov A-209M light (3,900 kg; 8,598 lb), nine-seat turboprop twin.

Meanwhile, manufacturing is turning increasingly to agricultural tractors and road sweepers. SAZ is earmarked for amalgamation within Sukhoi holding group under 2001 plans for Russian aerospace industry rationalisation. Personnel in 2003 totalled over 8,000, of whom 2,800 were engineers. Company affairs are managed by Aviacor at Samara and various schemes to recapitalise the plant have been considered including, in September 2003, a fact-finding visit by US Naval Air Systems Command.

SAZ also worked on a completely new type of lifting-body jet aircraft known as the EKIP project. It was the first company in the Russian Federation and Associated States (CIS) to receive a production certificate for commercial aircraft in compliance with international standards.

SGAU

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This prominent centre of aerospace learning includes a design bureau, SKB-1, in which students can develop their skills. Although this has concentrated on the small-scale manufacture of lightplanes, it has also designed — under leadership of Albert Elatonsev, its director — an executive transport designated Aist 92 (Stork 92) and has also produced space and medical equipment.

SMOLENSK

SMOLENSKY AVIATSIONNIY ZAVOD OAO
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GENERAL DIRECTOR: Aleksandr Miroshkin

CHIEF ENGINEER: Yury Litvinov

MARKETING MANAGER: Vladimir Merzlyakov

Smolensk Aircraft Plant (SmAZ) was established on 8 October 1926 as an aviation repair facility. In 1934, Buro Osovikh Konstruktsii, OKB for experimental aircraft, relocated from Moscow to Smolensk GAZ 35, specialising in manufacture of prototype and experimental aircraft, including BOK series of stratospheric and ultra-long-range vehicles. Evacuated 1941–1943 and later overhauled Il-2 attack fighter. After Second World War, built Myasishchev M-17/M-55, wings for Yak-40 transports, and more than 500 Yak-18Ts from 1973. In 2005, was seeking support to complete at least two M-55s remaining partly assembled at the plant. Built small number of early production Yak-42s alongside main series at Saratov (SAZ). Constructed Buran space shuttle. Government share was 25.5 per cent.

Production of Yak-18T was resumed 1993, five years after entire original fleet had been scrapped; more than 60 built up to 1996, when 15 placed in storage due to financial problems; production resumed in 1998; deliveries have included three to Ulyanovsk Aviation School in June 2001. Built three Yak-112 lightplanes before project transferred entirely to IAP0 in Irkutsk. Other work included manufacture of RPVs and cruise missiles; wings for the Yak-42, upgrading of Yak-40s for business use (including additional fuel capacity), and development and production (from 1993) of Technoavia SM-92 Finist seven-seat STOL aircraft. By 2002, was responsible for marketing Technoavia products. The SMG-92 TurboFinist is produced by Smolensk but marketed by Intracom Aero Design of Switzerland.

Has built wing and empennage for first three Sukhoi Su-38L agricultural aircraft and will be responsible for series production. Currently producing one further M-55, which has repeatedly failed to secure sufficient official annual funding to ensure completion. Also participated in Yak-130 programme, building prototype. Overhauls some 10 to 15 Yak-18Ts per year. Non-aerospace activities include manufacture of cloth processing machines, medical equipment, collapsible tubular metal furniture, and souvenir items such as badges.

In July 2004 was deleted from list of Strategic Enterprises of Russian State, permitting shares to be offered for private sale.

SMOLENSK (TECHNOAVIA) SM-92T TURBO FINIST

TYPE: Light utility turboprop.

PROGRAMME: Developed by Technoavia from radial-engined SM-92 Finist as turbo version.

Prototype (conversion of RA-44482) made first flight 6 March 2002 piloted by Mikhail Moltchanuk. Publicly demonstrated at MAK'S '03; in production at Smolensk.

Design of original version to FAR Pt 23 and JAR 23 standards, started July 1992; construction of first of two prototypes (RA-44482) began January 1993; first flight, as SM-92 Finist, made 28 December 1993; Russian manufacture of radial-engine version appears to have ceased. Similar SMG-92 Turbo Finist is marketed by Intracom of Switzerland, still built by Smolensk. According to Russian folklore, the Finist is a falcon with magic powers.

CUSTOMERS: Four completed by February 2004, plus further 17 radial-engine versions.

DESIGN FEATURES: Turboprop aircraft for multipurpose use, including paradropping, towing and ambulance. Optional wing hardpoints for cargo containers.

Originally designed as rugged light transport; in approximate class of DHC-2 Beaver, but less powerful and lower in cost than most used Beavers. Sweptback fin and rudder; small dorsal fin; tailplane mounted on fin, with single bracing strut each side. Wide CG range.

Basic aircraft accommodates up to seven persons with baggage. Convertible under field conditions to transport two stretcher patients and attendant with medical equipment; to drop six trainee parachutists or four firefighters with parachutes and firefighting equipment. Can carry hopper for agricultural chemicals in cabin, with spraybar, or cameras for forest surveillance, patrolling electric power lines, gas pipeline inspection and similar duties. Wingtip fuel pods optional; tanks have aerofoil-size central outout and are fitted slightly inboard of wingtip.

Special P-301 M-15 wing section by Technoavia and CAHI (TsAGI). No sweep; thickness/chord ratio 15 per cent; dihedral 2°; incidence 3° at root, 1° at tip.

FLYING CONTROLS: Conventional and manual. Ailerons and elevators pushrod-actuated; rudder cable-actuated. Electrically operated, three-position (0, 20, 40°), two-section single-slotted flaps on each wing; horn-balanced rudder and elevators, with fluted skin; trim tab on starboard elevator; ground-adjustable tab on rudder; three-section tab along entire trailing-edge of each aileron, centre section being adjustable on ground.

STRUCTURE: All-aluminium, stressed-skin semi-monocoque construction. Simple, reliable structure, with no expensive or exotic materials; repair possible under field conditions. Airframe life 10,000 hours or 20,000 landings, with 'on condition' extension.

LANDING GEAR: Tailwheel type; fixed. Fuselage-mounted spring steel cantilever mainwheel legs with medium-pressure mainwheel tyres, size 600x180 on KT-317 wheels. Steerable, semi-castering tailwheel with 255x110 tyre on tubular steel strut. Tyre pressure 2.45 bar (35.5 lb/sq in) on mainwheels; 2.95 bar (43 lb/sq in) on tailwheel. Wheel/skis and amphibious or plain floats optional. Pedal-operated disc brakes, with parking lock. Minimum turning radius 6.6 m (21 ft 8 in).

STUDENSKOYE KONSTRUKTORSKOYE BURO 1 (Student Design Bureau 1):

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DIRECTOR: Professor V M Shakhmistov

Bureau founded 1955 as part of Kuybishev Aviation Institute; absorbed into Samara State Aerospace University in 1994, following name change of home city. Has built Sverchok-1 gyroplane (1971), A-13 motor glider (1974), Shmel lightplane (1977), Strekoza lightplane (1978), Bat glider (1978), A-10 glider (1982) and A-18 Rusich motor glider (1987). More recent designs, previously described in detail, have been Che-15 and Che-25 (Chernov and Gidroplan manufacture) S-202 amphibian, A-16 aerobatic monoplane (1997), S-302 twin-engined amphibian (1995), S-400 four-seat amphibian (1998), Favorit two-seat ultralight (1998) and Crechet two-seat lightplane (1999). Current projects are the F-32 Yastreb and a flex-wing trike named Brazhnik. Yastreb was not placed in production.



Smolensk SM-92T Turbo Finist

1158647

POWER PLANT: One 559 kW (750 shp) Walter M 601E turboshaft driving an Avia V-508E/99B three-blade, fully feathering reversible-pitch propeller. Two main wing fuel tanks, total capacity 800 litres (211 US gallons; 176 Imp gallons). Optional wingtip fuel tanks, each of 200 litres (52.8 US gallons; 44.0 Imp gallons).

ACCOMMODATION: Pilot and seven passengers or 10 parachutists. Cargo version also available; quickly removable seats with folding armrests and back; dual controls standard for pilot training; adjustable rudder pedals. Small baggage container (or medical equipment stowage for ambulance version) on port side at rear of cabin. Forward-hinged, jettisonable door each side of flight deck; large rearward-sliding passenger/freight door on port side of cabin, openable in flight. Blister windows to flight deck and cabin. Steps on mainwheel legs and cable handholds for access to flight deck; removable tubular steel ladder beneath cabin door. SYSTEMS: Optional de-icing system. Electrical system provides 36/115 V AC power at 400 Hz and 28.5 V DC power, with 20NKBN-25 battery.

AVIONICS: Comms: Radio, transponder and GPS system intended to be of US origin.

Radar: Optional RDS2000 weather radar beneath starboard wing.

Flight: Optional autopilot.

Data generally as for SM-92 Finist, except that below.

DIMENSIONS, EXTERNAL:

Wing span 9.97 m (32 ft 8½ in)
Height overall 3.10 m (10 ft 2 in)
Wheelbase 6.59 m (21 ft 7½ in)

WEIGHTS AND LOADINGS:

Weight empty 1,550 kg (3,417 lb)
Max T-O and landing weight 2,700 kg (5,952 lb)
Max power loading 4.83 kg/kW (7.94 lb/shp)

PERFORMANCE:

Never-exceed speed (VNE) 221 kt (410 km/h; 254 mph)
Max operating speed 162 kt (300 km/h; 186 mph)
Normal cruising speed 140 kt (260 km/h; 162 mph)
Stalling speed, power off: flaps up 68 kt (125 km/h; 78 mph)
flaps down 60 kt (110 km/h; 69 mph)
Max rate of climb at S/L 600 m (1,968 ft)/min
Service ceiling 6,000 m (19,680 ft)
T-O run 300 m (984 ft)
T-O to 15 m (50 ft) 457 m (1,500 ft)
Landing run 200 m (656 ft)
Max range 810 n miles (1,500 km; 932 miles)

SMOLENSK (TECHNOAVIA) SM-2000

TYPE: Light utility turboprop.

PROGRAMME: Turboprop version of SM-2000P development of Yakovlev Yak-18T, combining aerodynamic refinements with stretched fuselage; intended to be main version. Prototype (RA-44445) first flown 17 July 2003 and made public debut at MAK'S '03, Moscow, August 2003. Russian certification obtained December 2004.

CUSTOMERS: One built and two on order by February 2004, by June 2005 three were under construction for customers in the United Kingdom.

COSTS: EUR470,000 basically equipped, ex-UK (2005).

DESIGN FEATURES: As Yak-18T and SM-2000P, but with longer fuselage, additional cabin door and wingtip pods. Airframe life 10,000 hours or 20 years.

FLYING CONTROLS: As SM-2000P, but incorporating electric trim on all three axes.

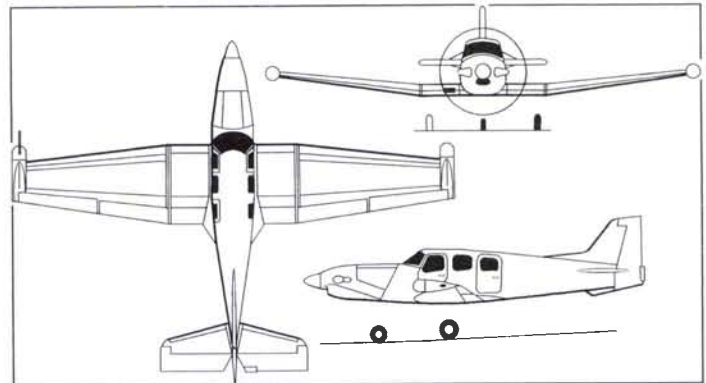
STRUCTURE: As SM-2000P but with extra cabin door, wing tip pods for weather radar and landing lights.

LANDING GEAR: As SM-2000P. Pneumatic emergency landing gear extension and braking.

POWER PLANT: One 560 kW (751 shp) Walter M 601E turboprop driving an Avia V-508E/99B three-blade, fully feathering reversible-pitch propeller. Fuel capacity 860 litres (227 US gallons; 189 Imp gallons) of which 845 litres (223 US gallons; 186 Imp gallons) are useable.



Prototype Smolensk (Technoavia) SM-2000 turboprop (Sebastian Zacharias) 0589420



Smolensk (Technoavia) SM-2000 five-seat turboprop 0567407

ACCOMMODATION: Five persons, including one or two pilot(s); rear three in semi-club arrangement with single forward-facing rear seat. Folding table. Crew door each side; passenger door port, rear.
SYSTEMS: BFGoodrich de-icing. Oxygen system.
AVIONICS: IFR standard fit.

Radar: Weather radar optional in starboard wingtip pod.

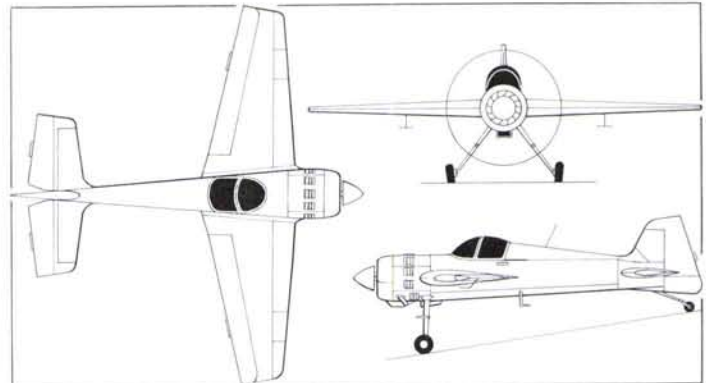
DIMENSIONS, EXTERNAL:	
Wing span over tip pods	11.88 m (38 ft 11¼ in)
Length overall	9.435 m (30 ft 11½ in)
Max width of fuselage	1.28 m (4 ft 2½ in)
Height overall	3.41 m (11 ft 2¼ in)
Wheel track	3.12 m (10 ft 2¾ in)
Wheelbase	1.95 m (6 ft 4¾ in)
Propeller diameter	2.50 m (8 ft 2½ in)
Crew doors: Width	0.78 m (2 ft 6¾ in)
Passenger door: Width	0.66 m (2 ft 2 in)
DIMENSIONS, INTERNAL:	
Cabin: Length between bulkheads	3.20 m (10 ft 6 in)
Max width	1.20 m (3 ft 11¼ in)
Max height	0.90 m (2 ft 11½ in)
Floor area	3.4 m² (37 sq ft)
Volume	3.5 m³ (124 cu ft)
WEIGHTS AND LOADINGS:	
Weight empty	1,350 kg (2,976 lb)
Max T-O weight	2,100 kg (4,629 lb)
Max power loading	3.75 kg/kW (6.16 lb/shp)
PERFORMANCE:	
Never-exceed speed (VNE)	259 kt (480 km/h; 298 mph)
Max operating speed (VMO)	208 kt (385 km/h; 239 mph)
Max cruising speed at FL98	216 kt (400 km/h; 249 mph)
Max rate of climb at S/L	660 m (2,165 ft)/min
T-O run	150 m (495 ft)
Landing run	350 m (1,150 ft)
Range with max fuel, 30 min reserves	864 n miles (1,600 km; 994 miles)

SMOLENSK (TECHNOAVIA) SP-55M

TYPE: Aerobatic single-seat sportplane.
PROGRAMME: Initial batch of five aircraft under construction in 2000 at Progress plant at Arsenyev; Russian prototype unregistered and first flown 20 October 2000; initial production aircraft, RA-44547, delivered in January 2001 to Richard Goode Aerobatics in UK; later sold to Australia.
CUSTOMERS: Six delivered by January 2005, to customers in Australia (Jace Harrison, VH-JCE), France, Russia (including RF-00888 of Youriy V Shaluev), the United Kingdom and the US.
COSTS: EUR115,000 (2003).
DESIGN FEATURES: Mid-wing configuration with symmetrical section of original Technoavia design; no dihedral, anhedral or incidence. Development of Yak-55M, last described in 1998–99 *Jane's All the World's Aircraft*. Modifications include redesigned rear fuselage turtleneck; new fin and tailplane fillets; reprofiled wingtips; redesigned flying surfaces with composites skin; steel engine firewall; new engine cowling; new instrument panel with US instruments and avionics; modified fuel and oil systems to FAR Pt 23 requirements; modified pneumatic system; pilot-controlled oil and carburettor heat doors; new entry steps and assist handle on fuselage and landing gear legs; inclined seat for increased g tolerance; new safety harness; baggage compartment and smoke system.



Smolensk (Technoavia) SP-55M early production aircraft (Sebastian Zacharias) 0589396



Smolensk (Technoavia) SP-55M single-seat sportplane (James Goulding) 0525057

FLYING CONTROLS: Conventional and manual. Near-full-span ailerons have narrower chord than those of Yak-55M, without horn balances; elevators and rudder of greater area than Yak-55M. Trim tab on each elevator. Suspended balance tab below each aileron.
STRUCTURE: Generally similar to Yak-55M. Metal, single-spar wing with composites-covered ailerons and composites tips. Metal fuselage with steel firewall; composites-covered elevator and rudder.
LANDING GEAR: Tailwheel type; fixed. Fuselage-mounted spring steel cantilever mainwheel legs on all three units; KT-98 mainwheels with 400x150 tyres; lockable, free-castoring tailwheel.
POWER PLANT: One 265 kW (355 hp) VOKBM M-14P air-cooled, nine-cylinder radial engine driving an MT-Propeller MTV-9-B-C/CL260-27 three-blade, constant-speed (hydraulic) metal propeller. Fuel in wing tanks, total capacity 120 litres (31.7 US gallons; 23.4 Imp gallons); inverted fuel and oil systems.
ACCOMMODATION: One person in inclined seat with recess for backpack parachute; fixed windscreen and one-piece sliding canopy.
SYSTEMS: Electrical system comprises lightweight 10 Ah generator and storage battery, both of US origin.
AVIONICS: Avionics fit of US origin.
EQUIPMENT: Optional smoke generation system; or glider hook.

DIMENSIONS, EXTERNAL:	
Wing span	8.00 m (26 ft 3 in)
Wing aspect ratio	5.3
Length overall	7.48 m (24 ft 6½ in)
Height overall	2.225 m (7 ft 3½ in)
Tailplane span	3.51 m (11 ft 6¼ in)
Wheel track	2.76 m (9 ft 0½ in)
Propeller diameter	2.50 m (8 ft 2½ in)
AREAS:	
Wings, gross	12.17 m² (131.0 sq ft)
Ailerons (total)	2.66 m² (28.63 sq ft)
Fin	0.40 m² (4.31 sq ft)
Rudder	1.02 m² (10.98 sq ft)
Tailplane	1.40 m² (15.07 sq ft)
Elevators (total)	1.79 m² (19.27 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	690 kg (1,521 lb)
Max T-O weight: training	855 kg (1,885 lb)
ferry	955 kg (2,105 lb)
Max wing loading: training	70.3 kg/m² (14.39 lb/sq ft)
ferry	78.5 kg/m² (16.07 lb/sq ft)
Max power loading: training	3.23 kg/kW (5.31 lb/hp)
ferry	3.61 kg/kW (5.93 lb/hp)
PERFORMANCE:	
Never-exceed speed (VNE)	194 kt (360 km/h; 223 mph)
Max level speed	173 kt (320 km/h; 199 mph)
Stalling speed	57 kt (105 km/h; 66 mph)
Max rate of climb at S/L	1,080 m (3,543 ft)/min
Max roll rate	360°/s
T-O run	170 m (558 ft)
Range with max fuel at econ cruising speed at 1,000 m (3,280 ft), 7% fuel reserves	415 n miles (770 km; 478 miles)
g limits	+9/−6

SOKOL**SOKOL NIZHEGORODSKY AVIATSTROITEL'NIY ZAVOD AOOT
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EXECUTIVE DIRECTOR: Valery G Drobishevsky

GENERAL DIRECTOR: Mikhail Shibaev

COMMERCIAL DIRECTORS: Oleg A Fedorov (Civil Programmes)

Viktor E Andrunun (Military Programmes)

Founded (as GAZ 21 in what was then Gorky) on 1 February 1932, this production plant concentrated on fighter aircraft manufacture until the start of the *konversiya* programme led to retooling for civilian production; registered as a JSC on 22 September 1994. Joined Kaskol group of companies in 2000.

Built 17,691 fighters up to end of Second World War and 43,557 aircraft up to 2002. From 1949, in collaboration with the Mikoyan OKB, it manufactured 2,148 MiG-15s (1949-51), 2,470 MiG-17s (1951-54), 1,125 MiG-19s (1955-58), 5,278 (or 5,752) MiG-21s (1957-85) and 1,186 MiG-25s (1966-85). Russian Ministry of Property holds 38 per cent of shares, which equivalent to 50.5 per cent of voting rights; remaining major shareholders are Financial & Industrial Bank (43.26 per cent) and Deposit Clearing Company (8.92 per cent), remaining 9,442 holders having less than 5 per cent. Current or recent products include the MiG-29UB (from kits supplied from Moscow), MiG-31 and Yak-130 jet trainer; first preproduction

aircraft completed in mid-2003. It is also responsible for supplying kits for upgrading 125 Indian Air Force MiG-21s to MiG-21-93 standard, with an initial order for 36. Agreement reached in July 2000 on upgrading half of Russian Air Forces' 280 MiG-31s.

Civilian programmes include manufacture of the Myasishchev M-101 six-seat turboprop light aircraft, a prototype AeroRIC Dingo amphibious aircraft with air cushion landing gear and Avia Accord twin-engined light multipurpose aircraft; plans also exist for Myasishchev M-202 production. M-101 marketing is first task of New Regional Aircraft Company (NORS), formed 18 April 2001 by Sokol, Myasishchev and Kaskol financial group. Announced February 2005 plans to build 45 M-101s over three years to meet increase in interest; deliveries began 15 November 2005. AeroRIC Research-Industrial Company is co-located with Sokol; by 2001 its Dingo project was in suspension because of financial shortfall.

Plans to build MiG-110 twin-turboprop transport apparently not overtaken by announcement in early 2000 of its reallocation to RSK 'MiG' (LAPIK plant) and discussions on continued participation in programme under way with RSK MiG in mid-2000. Transfer of MiG-110 to LAPIK was reaffirmed in late 2002. Agreement of 2001 covers production of wings and noses for navalised MiG-29K for India, plus complete MiG-29KUB trainers.

Production of the Eurospace F-15-F Excalibur four-seat touring aircraft was halted at an early stage when a contract for almost 100 was cancelled; several partly complete airframes remained at Nizhny Novgorod in June 2000, when 10 sold to Turbine Design in USA and further 30 transferred to China. As replacement, 1998 agreement with Aermacchi covers manufacture of SF-260 airframes, while in October 2004 preliminary talks held with Diamond Aircraft of Austria regarding components manufacture and collaboration on M-101 Light version of Myasishchev M-101.

Other products, in conjunction with AeroRIC, include Volga-2 WIGE craft, air cushion vehicles and Sokol 330 hydrofoil. Offers 'familiarisation' flights in MiG-29UB, MiG-21U and L-29 Delfin.

STRELA**STRELA PROIZVODSTVENNOYE OBEDINENIE
(STRELA PRODUCTION ASSOCIATION)**

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SALES MANAGER: Jim Rahm

The wholly state-owned Strela plant was established as GAZ 47 on 25 October 1941 and built the UT-2, Yak-6, ShCh-2 and Ts-25 glider between then and 1946. Returned to aviation manufacture in 1950 with Yak-14, Mi-1, La-17 up to 1964, by which time heavily involved in missile work including Lunar 14, 15 and 16 and Buran space projects. Currently manufactures BrahMos missiles and Kamov Ka-226 helicopter. Assembled prototype Ka-226; plans for Ka-226 series manufacture included first three or four production helicopters in 2001, but production investment of Rb300 million was not announced until January 2002, first two Ka-226s being complete by late March 2002. Factory has orders for 27 Ka-226s including 22 for Gazprom, of which seven completed by early 2006. It has produced replica Yak-3/Yak-9s and Mitsubishi A6M2s (Zeros) for export (20 Yaks and three Zeros built by December 2003, including two of latter for Hollywood film use and one in December 2003 for Japanese customer). A replica Yak-7 was under construction in 2003. Other products include satellite TV systems, gas heating boilers, seed drills, harrows and heat exchangers.

YAKOVLEV/STRELA BEAR 360

TYPE: Aerobatic two-seat sportplane.

PROGRAMME: Designed by Sergei Yakovlev, son of Aleksandr Yakovlev, and attributed to Yakovlev Aircraft Company, which unconnected with OKB Yakovlev. Prototype built by Strela in 1998; shipped to US in 2000 and reassembled at California City Municipal Airport, where first re-flown on 3 February 2001, registered N360BR; airworthiness certificate granted 15 April 2003. Marketing in US by Bear Aviation LLC; offered in fully-finished

Skip Holm Signature configuration with completion in US by Air Works Inc; or ARF (almost ready to fly) state for completion as desired by customer.

CUSTOMERS: None reported by 2006.

COSTS: USD125,000 ARF, less engine and instruments (2006).

DESIGN FEATURES: High performance, piston-engined design, recalling classic Bearcat/Hellcat and Yak-9 fighters, optimised for aerobatics, formation flying and touring; max rate of roll 180°/s. Low, trapezoidal wing and tailplane, former with leading-edge root extension; tall, trapezoidal fin with leading-edge fillet. Complies with FAR Pt 23 and also US Experimental and LSA categories.

Wing section NASA laminar flow 63-215 at root; 63-412 at tip. Dihedral 5°.

FLYING CONTROLS: Conventional and manual. Plain, piano-hinged ailerons; horn-balanced elevators with trim tab, port; mass-balanced rudder including flight-adjustable trim tab. Actuation by pushrods, except electrically actuated, slotted flaps and cable operation of trim tabs.

STRUCTURE: All metal. Wing built on single-piece, tapered main spar with stressed aluminium flush-riveted skin over stamped aluminium ribs; attached to fuselage at four points. Semi-monocoque fuselage, flush-riveted.

LANDING GEAR: Tailwheel type; retractable. Mainwheel legs, containing oleo-pneumatic struts, attached to main spar and surrounding structure, retract inwards; pneumatic actuation with gravity emergency extension. Mainwheel tyres 16x4.4 on prototype; 8.00-10 for production. Retractable tailwheel steerable with control column fully aft; castoring at other times; tyre 255x110. Cleveland wheels and hydraulic brakes.

POWER PLANT: One 265 kW (355 hp) VOKBM M-14PT nine-cylinder radial driving a Hoffmann HO-V183K-K/VL242BD three-blade, constant-speed, carbon fibre propeller. Optionally, 316 kW (424 hp) M-14NTK; MT-Propeller or Whirlwing propeller. Fuel in integral wing tanks, each 140 litres (37.0 US gallons; 30.8 Imp gallons), feeding centreline bladder collector tank; total capacity 288 litres 76.1 US gallons; 63.4 Imp gallons).

ACCOMMODATION: Two in tandem beneath rearward-sliding, single-piece blown canopy; separate, moulded windscreen of 9.5 mm (3/8 in) polycarbonate. Cockpits accommodate 99 percentile pilots; flyable at circuit speeds with canopy open. Baggage locker behind rear seat with external door, port. Dual controls.

SYSTEMS: Pneumatic system, pressure 55.2 bar (800 lb/sq in), for engine starting and landing gear actuation, using separate reservoirs. Electrical system 28 V DC, with 35 A Sukhoi SK35 alternator and 24 V battery back-up.

AVIONICS: US specification instruments, including GPS.

DIMENSIONS: EXTERNAL:

Wing span	7.00 m (22 ft 11½ in)
Wing aspect ratio	5.8
Length overall	7.05 m (23 ft 1½ in)
Wheel track	2.84 m (9 ft 3¾ in)



Yakovlev/Strela Bear 360, as marketed by Bear Aviation of US (Paul Jackson)

1159069

DIMENSIONS, INTERNAL:

Cabin max width at shoulder	0.65 m (2 ft 1½ in)
Baggage locker volume	0.12 m³ (4.2 cu ft)

AREAS:

Wings, gross	8.50 m² (91.5 sq ft)
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WEIGHTS AND LOADINGS:

Max baggage weight	34 kg (75 lb)
Max T-O weight	1,250 kg (2,755 lb)
Max wing loading	147.1 kg/m² (30.12 lb/sq ft)
Max power loading	4.72 kg/kW (7.76 lb/hp)

PERFORMANCE:

Never-exceed speed (VNE)	305 kt (564 km/h; 351 mph)
Max level speed: at S/L	250 kt (463 km/h; 288 mph)
at 1,000 m (3,280 ft)	230 kt (426 km/h; 265 mph)

Manoeuvring speed	as VNE
Cruising speed at 75% power at S/L	210 kt (389 km/h; 242 mph)
Stalling speed: flaps up	72 kt (134 km/h; 83 mph)
flaps down	68 kt (126 km/h; 79 mph)
Max rate of climb at S/L	564 m (1,850 ft)/min
T-O run	238 m (780 ft)
T-O to 15 m (50 ft)	320 m (1,050 ft)
Landing from 15 m (50 ft)	336 m (1,100 ft)
Landing run	252 m (825 ft)
Range at S/L, 20 min reserves	890 n miles (1,648 km; 1,024 miles)
g limits	+6/-3

SUKHOI (AVPK SUKHOI)

**GOSUDARSTVENNOYE UNITARNOYE PREDPRIYATIE
AVIATSIONNYI VOYENNO-PROMYSHLENNYI KOMPLEKS
SUKHOI
(STATE UNITARY ENTERPRISE, AVIATION MILITARY-
INDUSTRIAL COMPLEX SUKHOI)**

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Web: www.sukhoi.org

GENERAL DIRECTOR: Mikhail A Pogosyan

CHAIRMAN: B S Alyoshin

PRESS OFFICER: Yuri Chervakov

In October 2001, decree by Russian president created Sukhoi Aviation Holding Company, which became successor to AVPK Sukhoi, conducting initial board meeting on 29 October 2003. Sukhoi is wholly owned by Russian government and has holdings in following organisations: Sukhoi Design Bureau (50 per cent, plus one share), Sukhoi Civil Aircraft (86.4 per cent), KnaAPO (74.5 per cent), NAPO (74.5 per cent), TANTK (Beriev) (38 per cent) and Irkut (13.2 per cent). In all, these companies employ 35,000 personnel. Some 2,000 Sukhoi aircraft have been exported to 20 countries and 95 per cent of current production is for export. Sukhoi is world's third-largest manufacturer of modern fighters.

**Opytnyi Konstruktorskoye Buro Sukhogo OAO (Sukhoi Experimental Design Bureau
JSC)**

ulitsa Polikarpova 23B, 125284 Moskva

Tel: (+7 095) 941 01 30

Fax: (+7 095) 945 55 70

CHAIRMAN: B D Bregman

GENERAL DESIGNER: Mikhail Petrovich Simonov

OKB named for Pavel Osipovich Sukhoi, who headed it from 1939 until his death in September 1975. It remains one of two primary Russian centres for development of fighter and attack aircraft, and it is notable that 60 per cent of front-line Russian Air Forces' aircraft are of Sukhoi design. Bureau has widened its activities to include civilian aircraft, under *konversiya* programme, establishing separate division in 2000. This offsets the drastic reduction in combat aircraft production and competition in the upgrade and overhaul market.

Sukhoi Advanced Technologies

GENERAL DIRECTOR: Boris V Rakitin

This division is responsible for promotion and sales of Sukhoi light aircraft, such as the Su-29, Su-31, Su-38L and Su-49. Related activities include conversion of Su-26s and Su-29s with SKS-94 extraction systems.

**Nauchno-Proizvodstvennoe Kontsern Shturmoviki Sukhogo (Sukhoi Stormovik
Scientific-Production Concern)**

GENERAL DIRECTOR: Vladimir Babak

Offers of upgrades of Su-25 'Frogfoot' to Russian and export customers.

Grazhdanskie Samolety Sukogo (Sukhoi Civil Aircraft)

ulitsa Polikarpova 23B, 125284 Moskva

Tel/Fax: (+7 095) 941 01 60

e-mail: info@scac.ru

Web: www.scac.ru

GENERAL DIRECTOR: Andrey V Il'in

CHAIRMAN: V V Boyev

Subdivision formed May 2000, owned 86.4 per cent by Sukhoi Company and 13.16 per cent by Sukhoi Design Bureau. On 5 June 2000 signed agreement with Alliance Aircraft Corporation for joint development and production of StarLiner regional airliner. However, Sukhoi unilaterally cancelled agreement on 2 November 2000. In August 2001, Sukhoi revealed RRR (Russian Regional Jet) programme in collaboration with Boeing. This selected in 2003 for production. Is also developing SSBJ supersonic business jet, a programme begun in 1987, at one time involving partnership with Gulfstream of US.

SUKHOI Su-27

NATO reporting name: Flanker

TYPE: Air-superiority fighter.

PROGRAMME: Development of long-range heavy fighter to meet PFI (*perspektivnyi frontovoy istrebitel*: advanced frontal fighter) requirement began 1969 under leadership of Pavel Sukhoi; augmented in high-low mix by Mikoyan LPFI (later MiG-29). T10 based on 'integral' layout of unbuilt T4MS. Construction of prototype began in 1974 under Mikhail Simonov's supervision, and it was flown 20 May 1977 by Vladimir Ilyushin. Development undertaken by nine flying Su-27 'Flanker-As': four prototypes (T10-1 and T10-2) produced in OKB workshops; T10-3 and T10-4 built by Komsomolsk plant and assembled by OKB; five development (T10-5, -6, -9, -10 and -11) and one static test airframe at Komsomolsk.

Individual prototype designations duplicated some competing unbuilt T10 configurations. Prototypes had curved wingtips, rearward-retracting nosewheel and tailfins mounted centrally above engine housings.

Some variation between prototypes: T10-1 originally flew with 'clean' wing; four fences then added, followed by anti-flutter weights on wingtips and fins; inboard fences subsequently removed. T10-3 (first flight 23 August 1979) and T10-4 (first flight 31 October 1979) used AL-31F engines, others had AL-21F-3s. Canted tailfins from T10-3, T10-5, -6, -9, -10, and -11 had eight pylons (two below each wing) and -9 and -11 had long-chord ogival radomes; these five aircraft collectively known as T10-5 subvariant. Original configuration revealed poor controllability with inadequate stability in roll and yaw, and with poor high AoA capability; two pilots lost their lives before major airframe redesign resulted in T-10S production configuration (known internally as T10 junior).

Construction of new model began 1979, with first flight of prototype (T10-7) 20 April 1981, followed by second prototype (T10-12); T10-8 was T10S-0 static test airframe; series production by KnaAPO at Komsomolsk began with T10-15, first flown 2 June 1982; entry into service 22 June 1985 with air defence regiment co-located with Komsomolsk factory airfield; official type acceptance 23 August 1990 (Council of Ministers decree); ground attack role observed in 1991. Following purchase of complete aircraft, China signed licensed production agreement on 6 December 1996, covering further 200. Production continues for export. In late 1999, Sukhoi quoted 567 of Su-27 family in service in eight countries.

CURRENT VERSIONS: **Su-27: ('Flanker-B')** Single-seat land-based production version for air defence force (PVO); full-span leading-edge flaps, trailing-edge flaperons, 5 per cent increase in wing area, straight leading-edges, new aerofoil, square wingtips, carrying anti-flutter weights which doubled as AAM launchers; wider-spaced, uncanted tailfins outboard of engine housings; flatter canopy of reduced cross-section; extended tailcone instead of flat 'beaver-tail'; forward-retracting nosewheel; first flown (T10-7) 20 April 1981. Standard radar tracks 10 targets simultaneously, engages only one. There was early, but probably erroneous, speculation that PVO aircraft were designated Su-27P, with Su-27S designation applied to Frontal Aviation aircraft. All aircraft can carry Sorbtsiya-S active ECM jammer pods on wingtips in place of wingtip launch rails. Su-27S designation little used, but differentiates production (Series) from prototype and preproduction. By 2003, Su-27S designation being used to identify those aircraft which were awaiting Su-27SM modifications. Four initial production aircraft (T10-15, -17, -18 and -22) used for State Acceptance Tests were part of small initial batch featuring horizontally cropped fin caps.

Detailed description applies to the above version, except where indicated.

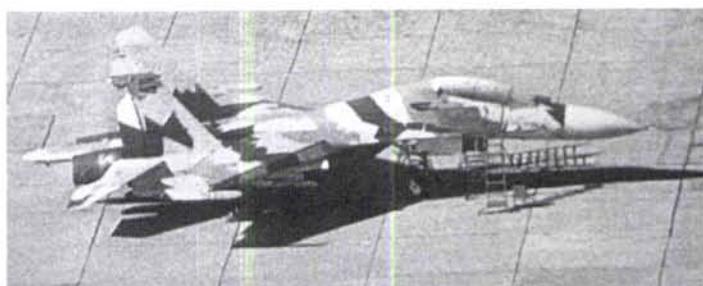
'Su-27RV': ('Flanker-B') Six replacement aircraft for Russian Knights aerobatic team feature GPS and Western-compatible communications equipment.

Su-27SK: ('Flanker-B') Export version of basic Su-27, using air-to-ground capabilities not exploited by Soviet/Russian Su-27s and using same weapons options and downgraded avionics. Armament, totalling up to 4,000 kg (8,818 lb), includes 250 kg and 500 kg bombs, B-8M1 packs of 20 × 80 mm rockets, B-13L packs of five 122 mm rockets, S-250FM 250 mm rockets, KMGU-2 cluster bombs, or podded SPPU-22 30 mm gun with optional downward-deflecting barrel for air-to-ground and air-to-air use. Dimensions, weights and performance generally similar to Su-27 but with reinforced landing gear giving increased (33,000 kg; 72,752 lb) MTOW. Chinese aircraft locally designated J-11, though this strictly applies only to locally manufactured examples. First Chinese-assembled aircraft flight tested in December 1998. Some later export aircraft may have upgraded radar and 6,200 kg (13,670 lb) weapon load, or even 8,000 kg (17,637 lb) according to some manufacturers' brochures.

Russian-managed upgrade of Su-27SK began 2004, including radar upgrade to N-1001VE standard with attendant ability to engage target with two Vympel RVV-AE AAMs simultaneously. Addition of indigeous PI-12 AAM has not been attempted, neither has expected an attempt made to add multirole capability.

Su-27SM: Mid-life update configuration in parallel to Su-27UBM and Su-30KN; developed by Ramenskoye Instrument Design Bureau and Sukhoi. Work undertaken at KnaAPO, Komsomolsk, where first conversion of Su-27S for Russian Air Forces flew on 27 December 2002; second followed by mid-2003. First five of contracted 24 Su-27SMs in initial three-year contract delivered to Lipetsk military test centre (4 CBPIPLS) for operational training, 25 December 2003. Further two delivered to Far East district on 23 December 2004 as initial equipment of 23 Regiment at Dzengi (Komsomolsk); last of initial 24 due in late 2006 (2004 seven; 2005 eleven; 2006 six). Second three-year contract under negotiation in 2006.

Avionics suite includes optimised air-to-air and air-to-ground weapon control systems, improved by new constituent elements and algorithms, with MTOW increased to 30,450 kg



Eritrean Sukhoi Su-27

1158619

(67,130 lb). Items include twin 310 × 152 mm (12¼ × 6 in) MFI-10-6M LCDs plus central MFPI-6 control screen; Elektroavtomatika SILS-27M HUD; Sh101V fire-control system and NJIP RLPK-27V (N-001V) multimode radar; OLS-27M (52Sh) frontal optronics for laser missile guidance; A737 satellite navigation receiver; and L175 Khibiny-M self-protection system including L150 radar warning receiver, APP-50 flares and active jammers. Weapon capabilities include R-77 BVR AAMs; Kh-31P, Kh-31A, Kh-29T/TE and Kh-29L ASMs; and KAB-500Kr and KAB-1500Kr guided bombs. No structural or engine improvements, but K-36D-3.5E ejection seat.

However, in April 2006, Salyut engine plant announced imminent availability of AL-31F-M1, which then undergoing State Tests in Su-27P '595' to prove additional 9.79 kN (2,200 lb st) output and 1,000-hour TBO (700 to 750 hours guaranteed, compared with current 300 hours). M1 engine stated to be due for incorporation on future Su-27SM conversions. Further, State Tests completed in late 2005 of BASPB fully automatic system for aircraft recovery after pilot's disorientation; developer Russkiy Sistemny announced intention to install system in Su-27SM after 2006.

Su-27SM2: Designation of Sukhoi Su-35 (described separately).
Su-27SMK: Alternatively known as Su-27SK Upgrade; stated to raise aircraft to 4+ fighter generation. Available for previously exported (single-seat) Su-27SKs and with features developed for Russian Air Forces' Su-27SM. Demonstrator '305' (the former Su-30KI 4002) first flew early 2003. Changes from baseline Su-27SK include upgraded fire control system for land, sea and air targets; LCD cockpit instrumentation; improved navigation integrated with Glonass and Navstar satellite systems; new elint system to facilitate ARM launching; new electro-optical sighting system with mode for semi-active laser homing air-to-surface missiles; expanded selection of missiles; in-flight refuelling; automatic mission data loading; and increased serviceability features.

Fire control update centred on SUV-UE air-to-air system (enhanced version of SUV-27, standard fit) with additional air-to-surface channel for active radar homing of anti-ship missiles, plus SUV-P air-to-surface system, additionally capable of displaying data to cockpit MFDs. SUV-UE has upgraded RLPK radar sighting system, and new OEPS electro-optic sighting and improved SILS-27M HUD. SUV-P based on standardised high-speed computers and integrated with SUO-30PK armament control system.

Data display based on two MFDs, multifunction LCD panel and modernised HUD. Some electromechanical indicators retained as backups.

Weapon options include previous R-27ER1, R-27ET1 MRAAMs and R-73E SRAAMs, now augmented by RVV-AE with active radar homing (total six); Kh-29T (TE) and Kh-29L TV/laser-homing ASMs (four), KAB-500Kr (four) or KAB-1500Kr (one) LGBs, Kh-31P passive ARMs (four) and Kh-31A active radar ASMs (four).

Su-27PD: Long-endurance test aircraft with retractable AAR probe, offsetIRST and recontoured tail 'sting'; sometimes described as single-seat Su-30, originally Su-27P.

Su-30KI: The Su-30KI prototype (4002, wearing the basic Chinese dark grey colour scheme, but with a disruptive camouflage superimposed on the wings, tailplanes and outer surfaces of the tailfins) first flew on 28 June 1998, and was then sent to Chkalov Flight Test Centre at Akhtubinsk, where it was evaluated and used for launch trials of the RVV-AE (AA-12 'Adder') AAM, and for avionics and refuelling probe verification. The Su-30KI was described as a 'single-seat Su-30', and was tailored to meet an Indonesian requirement, before the Asian economic crisis halted that programme. Extent to which the aircraft incorporated the 'extended endurance' features of the Su-30 (apart from refuelling probe, GPS and Western VOR/DME navigation equipment) remains uncertain, however. Su-30KI also used as basis of Sukhoi's latest proposal to upgrade Russia's in-service Su-27s, replacing Su-27SM. Upgrade programme still confusingly referred to by Sukhoi as the Su-30KI, although Russian Air Forces understood to use neither the Su-30 designation nor the KI suffix.

Su-27UB: ('Flanker-C') Tandem two-seat trainer version of 'Flanker-B' with full combat capability (Sukhoi designation T10U); four prototypes (first of which for static testing) built at Komsomolsk; first flown 7 March 1985 (T10U-1). Series manufacture by Irkutsk Aircraft Production Association began 1986; first production UB (T10U-4) flew on 10 September 1986. Instructor in raised rear seat with 6° view forward over the nose; taller fin; length same as 'Flanker-B'; overall height 6.36 m (20 ft 10¼ in), maximum combat load 8,000 kg (17,637 lb). 1,500 kg increase in empty weight, no reduction in internal fuel capacity. Export version is **Su-27UBK**.

Su-27UBM: Russian Air Forces upgrade. First modified Su-27UB (1201 '20') delivered from Irkutsk plant to LII at Zhukovsky 6 March 2001; further seven conversions planned before end of same year; two completed by September 2001; parallel programme to Su-30KN upgrade. Equipment includes new computer, GPS, three 152 × 203 mm (6 × 8 in) MFDs, RVV-AE (AA-12) missiles and ground mapping mode for N001 radar. Later improvements may include radar-absorbent paint and refuelling probe.

Su-27UBM1: Belarussian Su-27UB upgraded to this standard by 558th aircraft repair depot at Baranovichi in 2004; at least one other by early 2006. Reportedly is identical to Su-30KN. Belarus said to be interested in acquiring 18 surplus Indian Su-30Ks for similar upgrade.

'Aircraft 02-01': ('Flanker-C') Second Su-27UB flying prototype (Komsomolsk 0201) converted as in-flight refuelling systems testbed with retractable probe and provision for centrelines 'buddy' pod; first flown 6 June 1987. Later became Su-27PU.

Su-27M: Advanced development of Su-27. Still the official designation for the aircraft known to the OKB as the Su-35.

Su-27K: Described separately.

Su-27IB: Described separately.

Su-27PU: Two prototypes only; production as **Su-30**.

CUSTOMERS: About 395 in service with Russian Air Forces (or 340 plus 10 with training units by mid-2000, according to some sources); these reports refer to active inventory; evidence suggests that main production batches for former USSR contained up to 600 Su-27s and 140 Su-27UBs.

China received 26 (24 Su-27SK single-seat, two Su-27UBK two-seat) in 1991-92, followed by 24 more (14 single-seat, 10 two-seat) in 1995-96; original agreements called for licensed manufacture of 200 as J-11, at planned rate of 50 a year, in new purpose-built factory (owned by Shenyang Aircraft Company, which see) from 1998 (when first two shipsets delivered from Komsomolsk); first Chinese-assembled Su-27 rolled out December 1998; only eight delivered by late 2000, following considerable quality control problems, leading to the procurement of 28 extra Russian-built Su-27UBKs, delivered 2000-02, first four on 14 December 2000, second four in December 2000; to Nanjing/Yuxikou air base, where 10 supplied in 2001 and balance of 10 following in 2002. China's licence agreement does not allow exports. The first 50 aircraft assembled from Russian-supplied kits of diminishing completeness and the Chinese aircraft will always include at least 30 per cent Komsomolsk content; first 10 kits stated to have been 100 per cent complete but, by 2000, China seeking more in this state to expedite deliveries. No licence has been granted for Chinese production of the AL-31 engine. China's first 50 Su-27s were initially based at Wuhan, with the 9th Fighter Regiment, 3rd Air Division though 24 subsequently moved to Liancheng, where 17 were damaged (three beyond repair) in an April 1997 hurricane. Two more were written off in accidents. According to Russian sources, 75 of 78 complete Su-27

K/UBKs had been delivered by end of 2002 and all 105 sets of components representing first J-11 batch by end of 2004. At that time, China had not ordered balance of 95 sets, nor shown signs of switching local manufacture to Su-30, as once expected.

Vietnam received first batch of six (including one Su-27UB) in 1995; further six (two plus four) ordered, including two UBs delivered by airfreight on 1 December 1997 and second pair, representing balance of follow-on order, which destroyed in An-124 crash six days later. Latter replaced by single-seat aircraft, giving fleet of nine plus three; Su-30s also delivered. Upgrade expected, since Vietnam requires aircraft to use R-77 AAMs, Kh-29, Kh-31 and Kh-59 ASMs. Kazakhstan received 32 from Russia, including six in 1997, four in January 1999 and four during 2000 (with 12 then outstanding), as compensation for return of Tu-95s and for alleged environmental and ecological damage. Belarus has 22 or 23 (though these may have been sold-on, perhaps to Angola); Ukraine 66 to 70 and Uzbekistan 30; others reportedly went to Armenia, Azerbaijan and Georgia; Syria has requested 14 (some reports suggest 17 in service others that only four were in service by mid-2000, two at Minkah AB and two at Damascus).

Ethiopia received the first of eight second-hand from Russia in late 1998. Eritrea obtained four Su-27Ss and two Su-27UBs from Ukraine in 2002. In late 1999, there were reports that Angola had taken delivery of eight Su-27s at Catumbela in August, with the balance of seven expected imminently. Pilots had reportedly trained in Belarus, the presumed source of the aircraft, though technical support came from Ukraine. Indonesia announced in March 2003 that two Su-27s and two Su-35s would be purchased immediately as prelude to acquisition of total of 48 'Flanker' versions over following four years. Order signed 24 April 2003 and two Su-27SKs (and two Su-30MKs) delivered 27 August 2003 to Iswahyudi. Further six SKs (and two Su-30MKs) to follow.

Japan has been reported to be interested in two aircraft for evaluation/aggressor use, but Sukhoi unwilling to sell less than six. Two Japanese pilots underwent a USD300,000 46-day training programme on the Su-27 in early 1998, however.

On 26 November 1995, the first of two Su-27s was delivered from Belarus to the USA inside an An-124 for an unknown purpose, believed to be support of military training exercises. The UK is reported by one source to have obtained a "Su-27P" from Ukraine in 2001.

Su-27 CIS (USSR) PRODUCTION

Batch	Qty	Remarks
'Flanker-B' at Komsomolsk		
8	20	Full quantity unconfirmed
9	20	Including T10-30 (0906)
10	20	1003 with sidestick controller
		Some to Ukraine
11	20	
12	20	
13	20	Some to Ukraine
14	20	Some to Ukraine
15	20	Some to Ukraine
16	20	1602 to prototype Su-27M
17	20	Some to 582 IAP
18	20	
19	20	Some to 582 IAP and Ukraine
20	20	Some to 159 and 582 IAP
21	20	Some to 159 IAP and Ukraine
22	20	Some to 159 IAP
23	20	Some to 159 IAP
24	20	2404/T10-41; 2405 Su-27LMK; Some to 159 IAP
25	20	
26	20	Some to 159 and 582 IAP
27	20	Some to 159 and 582 IAP
28	20	
29	20	
30	20	Some to 61 IAP
31	20	Some to 237 GvTsPAT
32	20	
33	20	
34	20	Some to 61 IAP
35	20	
36	20	
37	20	3711 Su-27P; 3720 Su-27PD
'Flanker-C' at Irkutsk		
03	10	Some to Ukraine
04	10	
05	10	
06	10	
07	10	Some to 582 IAP
08	10	Some to 237 GvTsPAT
09	10	Some to 61 and 582 IAP
10	10	
11	10	Some to 582 IAP
12	10	Some to 582 IAP; 1201 first Su-27UBM
13	10	
14	10	
15	10	
16	10	Some to 237 GvTsPAT

Notes: Data from unofficial sources. Batches 9 and 10 may have contained fewer aircraft. IAP is Interceptor Air Regiment; GvTsPAT is Guards Centre for Display of Aviation Equipment

DESIGN FEATURES: Developed to replace Yak-28P, Su-15 and Tu-28P/128 interceptors in APVO, for dual-role ground attack/air combat and to escort Su-24 deep-penetration strike missions; basic requirement was effective engagement of F-15 and F-16 and other future aircraft and cruise missiles; exceptional range on internal fuel made flight refuelling unnecessary until Su-24s received probes when more range was required in the escort role; external fuel tanks still not considered necessary; all-swept blended fuselage/mid-wing configuration, with long curved wing leading-edge root extensions, lift-generating fuselage, twin tailfins and widely spaced engines with wedge intakes; rear-hinged doors in intakes hinge up to prevent ingestion of foreign objects during take-off and landing; integrated



Su-27SM upgraded version of Sukhoi 'Flanker' assigned to Lipetsk test centre (Yefim Gordon)

1158622



Sukhoi Su-27SMK demonstrator (Paul Jackson)

1158580

fire-control system with pilot's helmet-mounted target designator; exceptional high-Alpha performance; basic wing sweepback 42° on leading-edge, 37° at quarter-chord; no dihedral or incidence.

FLYING CONTROLS: Four-channel analogue SDU-27 fly-by-wire, with no mechanical back-up; artificial feel; relaxed longitudinal stability; no ailerons; full-span leading-edge flaps and plain inboard flaperons controlled manually for take-off and landing, computer-controlled in flight; differential/collective tailerons operate in conjunction with flaperons and rudders for pitch and roll control; flight control system limits *g* loading to +9 and normally limits angle of attack to 30 to 35°; angle of attack limiter can be overruled manually for certain flight manoeuvres; large door-type airbrake in top of centre-fuselage.

STRUCTURE: All-metal, with extensive use of aluminium-lithium alloys and titanium but no composites; comparatively conventional three-spar wings; basically circular section semi-monocoque fuselage with load-bearing spine, sloping down sharply aft of canopy; cockpit high-set behind drooped nose; large ogival dielectric nosecone; long rectangular steel blast panel forward of gun on starboard side, above wingroot extension; two-spar fins and horizontal tail surfaces; uncanted vertical surfaces on narrow decks outboard of engine housings; fin extensions beneath decks form parallel, widely separated ventral fins.

LANDING GEAR: Hydraulically retractable tricycle type, made by Hydromash, with single wheel on each unit; KT-156D mainwheels turn 90° while retracting forward into wingroots; hydraulically steerable non-braking KN-27 nosewheel, with mudguard, also retracts forward; mainwheel tyres 1,300 × 350, pressure 12.25 to 15.70 bar (178 to 227 lb/sq in); nosewheel tyre 680 × 260, pressure 9.30 bar (135 lb/sq in); hydraulic carbon disc brakes with two-signal anti-skid system; electric brake cooling fan in each mainwheel hub; further brake in nosewheel; brake-chute housed in fuselage tailcone.

POWER PLANT: Two Saturn/Lyulka AL-31F turbfans, each 122.6 kN (27,557 lb st) with afterburning. Large spring-loaded auxiliary air intake louvers in bottom of each three-ramp engine duct near primary wedge intake; two rows of small vertical louvers in each sidewall of wedge, and others in top face; fine grille of titanium hinges up from bottom of each duct to shield engine from foreign object ingestion during take-off and landing.

By 2004, Salyut offering AL-31F upgrade for export in form of 132.4 kN (29,760 lb st) AL-31F-M1, with 138 kN (31,085 lb st) AL-31F-M2 and 147.1 kN (33,070 lb st) -M3. Target TBO for these engines is 1,500 hours, increasing to 4,000.

Fuel in four integral tanks; three in fuselage and one split between each outer wing. Max internal fuel capacity approximately 11,775 litres (3,110 US gallons; 2,590 Imp gallons); normal operational fuel load 6,600 litres (1,744 US gallons; 1,452 Imp gallons). Higher figure represents internal auxiliary tank for missions in which manoeuvrability not important. No provision for external fuel tanks, except in versions where specifically

indicated. Pressure or gravity fuelling. Flight refuelling capability optional; Su-27UB operated as buddy tanker during development of system.

ACCOMMODATION: Pilot only, on Zvezda K-36DM Series 2 zero/zero ejection seat, under large rear-hinged transparent blister canopy, with low sill; 14° view downward over the nose.

SYSTEMS: Automatically regulated cockpit air conditioning. Two independent, duplicated, hydraulic systems, pressure 275 bar (4,000 lb/sq in), for actuation of control surfaces, airbrake, landing gear, wheel brakes, air intake ramps and FOD screens. Electrohydraulic (flight control) parts of system quadruplicated. APU in top of rear fuselage for ground and emergency in-flight power. Pneumatic system pressure 210 bar (3,045 lb/sq in) for back-up landing gear extension avionics bay pressurisation and canopy operation and sealing. Electrical supply 27 V DC, 115 V and 200 V 400 Hz AC; two type NKBN-25 Ni/Cd batteries. AC supplied by two integral engine-driven generators with three-phase and single-phase converters. Gaseous oxygen for 4 flight hours.

AVIONICS: Systems integrated by NPO Elektroavtomatika.

Communications: R-800 UHF radio, R-864 HF, intercom and cockpit voice recorder. SO-69 ATC transponder; various IFF fits, according to production batch.

Flight: PNK-10 flight instrumentation and navigation suite encompasses the usual, traditional flight instruments (the IK-VSP altitude and speed data system), SAU-10 autopilot, Ts-050 computer, ARK-19 or ARK-20 ADF, a radio altimeter and A-317 Uron SHORAN. Aircraft capable of ICAO Cat. I autoland.

Radar: RLPK-27 radar sighting system with NIIP N001 Mech (Sword, NATO 'Slot Back') track-while-scan coherent pulse Doppler look-down/shoot-down radar (long-chord twist-cassegrain antenna diameter approximately 1.0 m; 3 ft 4 in) with search range of up to 54 n miles (100 km; 62 miles), tracking range 35 n miles (65 km; 40 miles), in forward hemisphere against MiG-21 size target (ability to track 10 targets and engage two simultaneously in current Su-27SK/UB upgrade configurations) and TsVM-80 computer.

Instrumentation: Integrated fire-control system enables radar,IRST and laser range-finder to be slaved to pilot's helmet-mounted target designator and displayed on wide-angle HUD; autopilot able to restore aircraft to right-side-up level flight from any attitude when 'panic button' depressed.

Mission: Duplex SUV-27 weapons targeting complex integrates radar and OEPS-27 electro-optic sighting system with Model 36Sh OLS-27 IR search/track (IRST) sensor, range 27 n miles (50 km; 31 miles), collimated laser range-finder, range 4.3 n miles (8 km; 5 miles), functioning through common optics in transparent housing forward of windscreen and NSTs-27 Schchel-3U helmet-mounted sight, Beryuza tactical/GCI datalink. Provision for reconnaissance pod on centreline pylon.

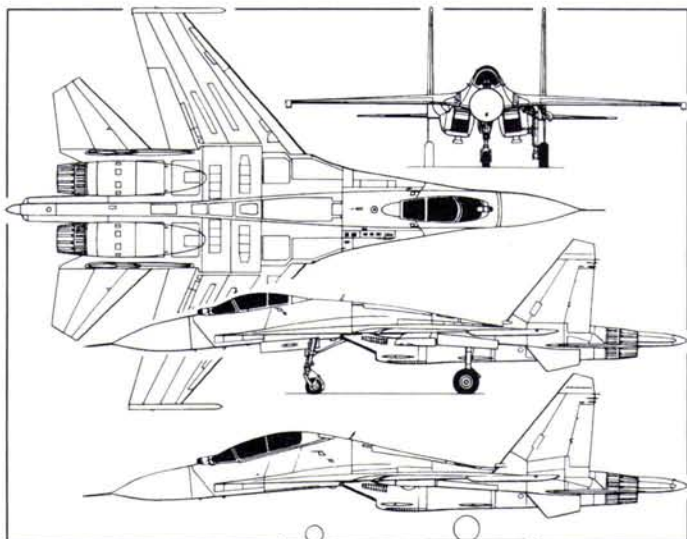
Self-defence: SPO-15LM Beryuza 360° radar warning antennas, outboard of each bottom air intake lip and at tail. Gardeniya active ECM jamming system. Three banks of APP-50 chaff/flare dispensers (total 96 cartridges) in bottom of long tailcone extension and top of tailfing. Tailcone widened to provide extra chaff/flare dispensers from batch 18 (mid-1987).

ARMAMENT: One 30 mm Gryazev/Shipunov 9A-407IK GSh-30-1 gun in starboard wingroot extension, with 150 rounds. Up to 10 AAMs in air combat role, on tandem pylons under fuselage between engine ducts, beneath each duct, under each centre-wing and outer-wing, and at each wingtip. Typically, two short-burn semi-active radar homing R-27R (NATO AA-10A 'Alamo-A') in tandem under fuselage; two short-burn IR homing R-27T (AA-10B 'Alamo-B') on centre-wing pylons; and long-burn semi-active radar homing R-27ER (AA-10C 'Alamo-C') or IR R-27ET (AA-10D 'Alamo-D') beneath each engine duct. The four outer pylons carry either R-73A (AA-11 'Archer') or R-60 (AA-8 'Aphid') close-range IR AAMs. R-33 (AA-9 'Amos') AAMs optional in place of AA-10s. Up to eight 500 kg bombs, sixteen 250 kg bombs or four launchers for S-8, S-13 or S-25 rockets.

DIMENSIONS, EXTERNAL (Su-27):

Wing span	14.70 m (48 ft 2 3/4 in)
Wing aspect ratio	3.5
Length overall, excl nose probe	21.94 m (71 ft 11 1/2 in)
Height overall	5.93 m (19 ft 5 1/2 in)
Fuselage: Max width	1.50 m (4 ft 11 in)
Tailplane span	9.88 m (32 ft 5 in)
Distance between fin tips	4.30 m (14 ft 1 1/4 in)

Su-27 EXPORT PRODUCTION				
Country	Type	Qty	First Aircraft	Remarks
China	Su-27SK	24	'05'	Batch 38 and 39; delivered from Komsomolsk 1991-92
	Su-27SK	14	'35'	Batch 39; 1995-96
	Su-27SK	105	'01'	All kits received by early 2004. Local assembly in progress; further 95 to follow
	Su-27UBK	2	'01'	Delivered 1991-92 from Irkutsk
	Su-27UBK	10	'03'	1995-96
Indonesia	Su-27UBK	28	'51'	2000-02
	Su-27SK	2	TS-2701	2003
		6		On order; purchase approval delayed to June 2006; may include Su-30Ms
Vietnam	Su-27SK	5	6001	
		4		Incl two replacements for Su-27UBKs
	Su-27UBK	1	8521	
		4		Two lost in airfreight delivery



Sukhoi Su-27P, with added side elevation (bottom) of two-seat Su-27UB
(Dennis Punnett)

1159577

Wheel track	4.36 m (14 ft 3 3/4 in)
Wheelbase	5.88 m (19 ft 3 3/4 in)
AREAS:	
Wings, gross	62.04 m ² (667.8 sq ft)
Wing leading-edge flaps (total)	4.60 m ² (49.51 sq ft)
Flaperons (total)	4.90 m ² (52.74 sq ft)
Fins (total)	11.90 m ² (128.10 sq ft)
Rudders (total)	3.50 m ² (37.67 sq ft)
Horizontal tail surfaces (total)	12.30 m ² (132.40 sq ft)
WEIGHTS AND LOADINGS (A: Su-27, B: Su-27UB, C: Su-27SK, D: Su-27SMK):	
Operating weight empty: A	16,380 kg (36,110 lb)
B	17,500 kg (38,580 lb)
Max fuel weight: A	9,400 kg (20,723 lb)
Normal T-O weight: A	23,000 kg (50,705 lb)
B	24,140 kg (53,220 lb)
D, with two R-73 and two R-27 missiles	23,700 kg (52,250 lb)
Max T-O weight: A, C, D	33,000 kg (72,750 lb)
B	33,500 kg (73,850 lb)
Max wing loading: A, C, D	531.9 kg/m ² (108.94 lb/sq ft)
B	540.0 kg/m ² (110.60 lb/sq ft)
Max power loading: A, C, D	135 kg/kN (1.32 lb/lb st)
B	124 kg/kN (1.22 lb/lb st)
PERFORMANCE:	
Max level speed: at height: A, B	M2.35 (1,350 kt; 2,500 km/h; 1,550 mph)
C	M2.3 (1,319 kt; 2,443 km/h; 1,518 mph)
D	M2.17 (1,241 kt; 2,300 km/h; 1,429 mph)
at S/L:	
A, B	M1.1 (725 kt; 1,345 km/h; 835 mph)
C, D	M1.14 (756 kt; 1,400 km/h; 870 mph)
Stalling speed: A	108 kt (200 km/h; 125 mph)
Acceleration (D):	
from 324 to 594 kt (600 to 1,100 km/h; 373 to 683 mph)	15 s
from 594 to 701 kt (1,100 to 1,300 km/h; 683 to 808 mph)	12 s
Rate of roll: A	approx 270°/s
Service ceiling: A, D	18,000 m (59,060 ft)
B	17,500 m (57,420 ft)
C	18,500 m (60,700 ft)
T-O run: A	450 m (1,475 ft)
B	550 m (1,805 ft)
C, D	650 m (2,135 ft)
Landing run: A, D	620 m (2,035 ft)
B	700 m (2,300 ft)
Combat radius: A, B	810 n miles (1,500 km; 930 miles)
D	840 n miles (1,560 km; 970 miles)
Range with max fuel: A, C	1,985 n miles (3,680 km; 2,285 miles)
B	1,620 n miles (3,000 km; 1,865 miles)
Range (D): at S/L, internal fuel	745 n miles (1,380 km; 857 miles)
at S/L, with external tanks (dropped when empty)	
894 n miles (1,656 km; 1,029 miles)	
at height, internal fuel	2,046 n miles (3,790 km; 2,355 miles)
at height, with external tanks (dropped when empty)	
2,370 n miles (4,390 km; 2,727 miles)	
max, with flight refuelling	2,807 n miles (5,200 km; 3,231 miles)
g limit (operational): A, B, C, D	+9

SUKHOI Su-30 (Su-27PU)

NATO reporting name: Flanker-F Variant I

TYPE: Air superiority fighter.

PROGRAMME: Design started 1986; proof-of-concept T10PU (T10U-2 'Aircraft 01-02'; see Su-27 entry) first flew 6 June 1987; construction of two prototypes (T10PU-5 '05' and T10PU-6 '06', converted from Su-27UBs T10U-5 and 0201/T10U-6) began at Irkutsk in 1987, as Su-27PU; first flown 31 December 1989; prototype flew 7,252 n miles (13,440 km; 8,351 miles) in 15 hours 42 minutes non-stop during round trips Moscow-Novaya Zemlia-Moscow and Moscow-Komsomolsk-Moscow. First pre-series Su-27PU flew at Irkutsk on 14 April 1992; initial two aircraft (27596 and 27597 c/n's 0101 and 0102), without military equipment, delivered to 'Test Pilots' aerobatic team at Zhukovsky flight test centre, possibly as Su-27PUDs. By 1999, 27597 was flight-testing MFI-68 152x203 mm (6x8 in) LCDs for Russian 'Flanker' upgrade programmes while 27596 had been used in support of the Su-30MK programme, renumbered '603'.

CURRENT VERSIONS: **Su-30:** (Sukhoi T10PU, *Izdelie* 10-4PU): Unofficial OKB designation for

basic two-seat long-range interceptor for Russian Air Forces (to which it is still the Su-27PU); deliveries under way by 1996 to 54 Interceptor Air Regiment at Savostleyka advanced training base, though production very limited, and unit relies heavily on Su-27 and Su-27UB. Apparently, five Su-30s are in frontline use (Red 50, 51, 52, 53 and 54). Designed for mission of 10 hours or more with two in-flight refuellings; systems proved for extended duration sorties, including group missions with four Su-27s; only Su-30 would operate radar, enabling it to assign targets to Su-27s by radio datalink; can carry bombs and rockets but not guided air-to-surface weapons. Su-27UB training capability retained. Canards and thrust vectoring to be optional (see Su-30MK1). Export designation **Su-30K** (T10-4PK). Situation confused by tendency to describe all current Irkutsk-built two-seaters as Su-30s, even standard Su-27UB trainers and by emergence of upgrade using MiG-29SMT cockpit, using the same Su-30K designation. This Su-30K was reported to have been tested at Akhtubinsk by June 2000 but may be the same as the Su-30KM described below. Reported in early 2002 that 'Russian Knights' aerobatic team to convert to Su-30s from Su-27s.

Su-30KI: Single-seat configuration for Indonesia, subsequently offered more widely as an upgrade. Described in main Su-27 entry.

Su-30I: One foreplane-equipped Su-27PU prototype only; served as Su-30MK1 prototype; believed offered as upgrade for Su-27 and as naval trainer, but neither taken up.

Su-30K-2: Variant of Su-33UB and described in that entry.

Su-30KN: An undelivered production Su-30 (0302 '302') first flew in early March 1999 as the testbed (also referred to as Su-30K and Su-30KM) for a Russian Air Forces upgrade of UB Su-27s and Su-30s. Prime purpose of 'Project 302' was to convert fighter into multirole attack aircraft by adding terrain-mapping and moving target indication to the N001 radar. This achieved by adding new bypass circuit (*obvodnoy kanal*, abbreviated to *Oko* — 'eye'). Cockpit initially unchanged, apart from MFI-55 127 x 127 mm (5x5 in) MFDs, an SUV-30K weapons control system comprising a new MVK computer added to existing SUV-27 system (permitting new types of AAM and ASM to be carried) and an A737 GPS; joint venture is undertaken by Sukhoi, Irkutsk (IAP) and Russkaya Avionika and has high commonality with MiG-29SMT upgrade. Prototype tested at Air Forces Research Institute from mid-1999. State certification awarded 9 November 2001. Added weapons are Kh-29T short-range, or two Kh-59ME long-range TV-guided ASMs; up to six KAB-500KR bombs; four Kh-31P ARMs; and six Kh-31P/A anti-ship missiles. By late 2000, the Su-30KM designation had been replaced by Su-30KN and potential maritime capabilities were being stressed, including possible future compatibility with Kh-59, Yakhont and Alfa ASMs. Up to November 2001, upgrades comprised prototype '302' and three air force aircraft ('51' being the first), all used for trials and modernised at IAP's expense; order signed by Russian Air Forces in October 2001 for eight upgrades in 2002, 10 in 2003 and 12 in 2004. However, by August 2003, only five upgraded aircraft had been redelivered. Su-27UBM and Su-27SM are parallel programmes. 12 Su-30Ks sought by Vietnam believed to be to this standard with Kh-29, Kh-31 and Kh-59 ASMs, KAB-500 PGMs and R-77 AAMs.

Su-30KNM: Subsequent modifications to 0302 involve larger (152 x 203 mm; 6 x 8 in), MFI-68 screens (three for pilot and four for WSO). Pero ('Feather') phased-array radar and equivalent of MIL-STD-1553B databus. Project began in 2002. Upgrade of air force aircraft could begin 2005.

Su-30M: (Sukhoi T-10PM): Multirole version; described separately.

CUSTOMERS: See table. Indian aircraft to be upgraded to Su-30MK1 in 2004, according to one report. This failed to occur, but in May 2006, India was negotiating for return of all 18 to Irkut production plant and their replacement by new Su-30MKIs; Belarus has shown interest in ex-Indian machines.

DESIGN FEATURES: Development of Su-27/27UB, with latter's tandem seating and new avionics, and without Su-35's advanced radar, foreplanes (in basic version), advanced control system and new power plant. Designed for effective engagement of fighters at long distances from base, and to destroy bombers and intercept cruise missiles. Integral configuration similar to Su-27UB, with unstable aerodynamic characteristics. Automatic control system standard.

FLYING CONTROLS: As Su-27UB.

STRUCTURE: As Su-27UB.

LANDING GEAR: As Su-27UB.

POWER PLANT: As Su-27UB, but flight refuelling probe and buddy refuelling capability standard.

ACCOMMODATION: Two crew in tandem in identical cockpits, on K-36DM zero/zero ejection seats, with rear seat raised.

SYSTEMS: As Su-27UB, except gaseous oxygen for 10 hours' flight.

AVIONICS: Radar: NIIP N001 Myech ('Slot Back') coherent pulse Doppler look-down/shoot-down radar offered, detection range up to 54 n miles (100 km; 62 miles), tracking range 35 n miles (65 km; 40 miles); ability to track 10 targets and engage two simultaneously; probably not available on current in-service aircraft.

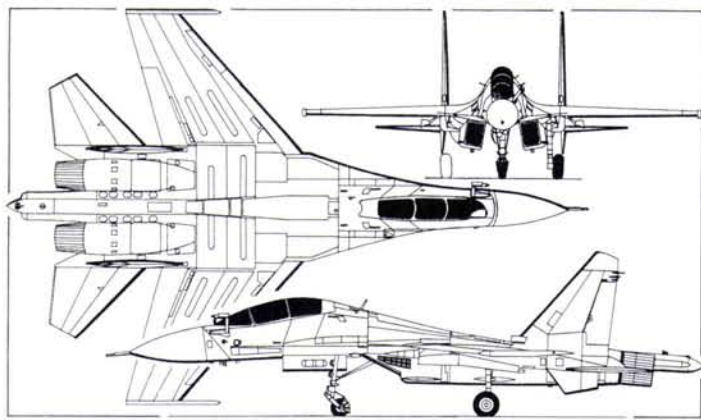
Flight: New navigation system based on GPS, Loran and Omega.

Instrumentation: Integrated fire-control system enables radar,IRST and laser range-finder to be slaved to pilot's helmet-mounted target designator and displayed on wide-angle HUD.

Mission: Provision for fitting foreign-made airborne and weapon systems at customer's request.

Self-defence: SPO-15LM Beryozha 360° radar warning system; chaff/flare dispensers.

ARMAMENT: One 30 mm GSh-301 gun, with 150 rounds; 12 hardpoints for up to six R-27R1E and R-27T1E (AA-10 'Alamo') radar homing and IR long-range AAMs, and six R-73E (AA-11 'Archer') IR close-range AAMs; alternative RVV-AE (R-77; AA-12 'Adder') AAMs; unguided bombs or rockets as Su-27; reconnaissance or EW pods.



Sukhoi Su-30 two-seat long-range combat aircraft (Paul Jackson)

1159576



Indian Air Force Sukhoi Su-30Ks (French Air Force)

1158626

Su-30 PROTOTYPES AND PRODUCTION

Batch	Qty	Identity	Remarks
Russia			
	(1)	T10PU-5 '05'	Converted from T10U-5; became Su-30MKK
	(1)	T10PU-6 '06'	Converted from T10U-2; became Su30MKI
1	1	'596'	Became '603' for Su-30MK programme
1	1	'597'	Testbed at Zhukovsky (LII)
2/3	5	'50' – '54'	54 IAP PVO, Savostleyka
3	1	'302'	Upgrade prototype (Su-30KN)
India			
PU	8	SB001-008	Delivered March-April 1997
K	10	SB009-018	Ordered September 1998. Delivered October 1999. Batch 5 production

DIMENSIONS, EXTERNAL: As Su-27UB

WEIGHTS AND LOADINGS:

Fuel weight: normal	5,090 kg (11,222 lb)
max	9,400 kg (20,723 lb)
Max combat load	8,000 kg (17,635 lb)
Max external stores	8,000 kg (17,635 lb)
Normal T-O weight	24,550 kg (54,123 lb)
Max T-O weight	33,000 kg (72,752 lb)

PERFORMANCE:

Max level speed:	
at height	M2.35 (1,350 kt; 2,500 km/h; 1,550 mph)
at S/L	M1.14 (756 kt; 1,400 km/h; 870 mph)
Service ceiling	17,500 m (57,420 ft)
T-O run	550 m (1,805 ft)
Landing run	700 m (2,300 ft)
Combat range: with max internal fuel	1,619 n miles (3,000 km; 1,865 miles)
with one in-flight refuelling	2,805 n miles (5,200 km; 3,230 miles)
g limit	+8.5

SUKHOI Su-30M

NATO reporting name: Flanker

TYPE: Multirole fighter.

PROGRAMME: Design started 1991; demonstration and development work by Su-27UB 0806 '321' and 0403 '56'; 'Blue 56' first flew in Su-30M configuration on 14 April 1992, but it was not then canard-equipped and did not have full avionics package. Conversion of first true prototype ('06') began 1993, using 0201/T10PU-6; 0101 '603' (formerly first prototype Su-27PU-5) first demonstrated at Berlin Air Show 1994; thrust vectoring and canards under development as options 1997. Canards and AL-37FP engines first flown on '56' 1 July 1997, this regarded by Sukhoi as first flight of Su-30MK; second prototype (06) flew 23 April 1998. In production for India.



Late production ('72') Chinese Sukhoi Su-30MKK

1158631

Su-30M designation initially associated with canard fitment. However, this now appears to identify multirole aircraft with upgraded airframe capable of 38,800 kg (85,539 lb) MTOW, irrespective of aerodynamic configuration. Chinese Su-30MKKs are described by Sukhoi as Su-30MK family members, despite having twin nosewheels and square-topped fins previously regarded as Su-35 features.

CURRENT VERSIONS: **Su-30M:** (Flanker-F Variant 2) Basic version.

Su-30MK: Irkutsk-built. As Su-30M, for export.

Su-30MK: Designation re-used for advanced two-seater derived from Su-27SK by KnAAPO plant and combining two-seat Su-30 concept with avionics, canards and thrust vectoring of Su-37. Design, under A F Barkovsky, began 1994. Known internally (by KnAAPO) as Su-35UB (T10UBM) and Su-37UB. First and second true Su-30MKs, 01 (produced through the retrofit of canards to '56') and 06 (converted from T10PU-6 in Sukhoi OKB's own workshop) first flown on 1 July 1997 and 23 April 1998, respectively. Equipped with foreplanes and AL-37FP thrust-vectoring engines; demonstrated to Indian officials at Zhukovsky, 15 June 1998 as Su-30MK-1 and Su-30MK-6, respectively. Su-30MK-1 had the new twin-wheel nosegear, which may become a feature of the production MKI, but was lost while displaying at Paris Air Show on 12 June 1999. Additionally, 01 was exhibited at Aero India, December 1998. AL-37FP power plant, as specified for India, extends length by 40 cm (15³/₄ in) and incurs weight penalty of 110 kg (243 lb), engine life remaining unchanged at 5,000 hours (1,000 hours TBO). Nozzle movement is 15° up or down. Flight control system helps pilot to set power and thrust vector for each engine, according to required manoeuvre. Expected to be known as Su-30MKR if produced (at Irkutsk) for Russian Air Forces.

Su-30MKA: Algerian order of March 2006 for 28. Generally as Su-30MKI, but with certain Israeli-built components omitted (as with Su-30MKM); cockpit in French.

Su-30MKI: (Flanker-H) Version for India in four configurations, initially referred to as Su-30MKI, MKII, MKIII and MKIV. Indian contract signed 30 November 1996. First eight delivered March 1997 to basic Su-30PU (Su-30K or even Su-37UB) standard, with AL-31F engines; eight for 1998 delivery were expected to have French Sextant avionics including VEH 3000 HUDs, high-resolution colour LCD MFDs, a new flight data recorder, a Totem ring laser gyro dual INS with embedded GPS. Cockpits stated to be "practically identical" although rear seat occupant normally operates radar, systems and weapons. Israeli EW equipment, a new UOMZ OLS-30 electro-optic targeting system and rearward-facing radar in tailcone; 12 originally to have been delivered 1999 were to add canards, as on Su-37; final 12 (originally scheduled for delivery in 2000) were to have AL-37FP engines with single-axis thrust-vectoring nozzles inclined outwards 32° from the centreline for improved yaw control, especially in single-engined case. AL-37FP claimed to offer 3-D thrust vectoring, with nozzle actuation via the fuel, and not the hydraulic, system.

Completion and delivery of balance of 32 was repeatedly delayed; decision taken that all these would be completed to final standard before delivery. (In interim, India contracted on 18 December 1998 for 10 standard Su-30Ks which had been cancelled by Indonesia; all had been delivered by October 1999.) First prototype full-specification Su-30MKI flew at Irkutsk on 26 November 2000; Irkutsk built four prototypes, last of which handed over to Sukhoi design bureau on 11 August 2001.

First production aircraft flew 28 December 2001. Under renegotiated contract, IAF to receive six full-specification aircraft by 2002 and balance of 26 in batches beginning 18 to 24 months later; Batch 1 and 2 aircraft (22 in all) will be raised to full standard under agreement of 6 January 2006.

First two departed Irkutsk inside An-124 transport 22 June 2002. However, 'full-specification' still being received in three standards, first 10 being Stage I; these 10 formally accepted into service by 20 Squadron at Pune 27 September 2002. Stages II and III, (12 in 2003 followed by 10 in 2004), introduced additional weapons and upgraded flight control system. Licensed production of 140 Su-30MKIs by HAL was agreed in September 2000.



Chinese naval aviation Sukhoi Su-30MKK2

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followed by contract signature in Irkutsk on 28 December 2000. Sometimes referred to by KnAAPO as Su-35UB.

Pending local manufacture, India proposing in mid-2006 to trade-in 18 Su-30s for similar number of Su-30MKIs. Locally-built aircraft expected to carry Irbis radar, developed jointly by NIIP and India's LRDE.

Su-30MKK: ('Flanker-G') Second K stands for *Kitaya*, or China. Two-seat, multirole version, with an N001VE radar (with expanded air-to-ground capabilities, including mapping); 'glass cockpit' with two 178 × 127 mm (7 × 5 in) MFI-9 colour LCD MFIDs in front, plus single MFI-9 and 204 × 152 mm (8 × 6 in) MFI-10 in rear; ILS-31 HUD; A737 GPS; expanded EW capability; provision for various new TV- and EO-based targeting pods.

First Su-27PU (T10PU-5) was refurbished and rebuilt to serve as an Su-30MKK development aircraft, first flying in its new guise on 9 March 1999. First KnAAPO built prototype ('501') flew 19 May 1999 (sometimes reported as 20 February 1999), with second ('502'), in basic Chinese camouflage scheme but marked simply as Su-30MK, not MKK) following later in 1999. '501' and '502' representative of planned production configuration, with tall, flat-topped Su-35-type tailfins, retractable in-flight refuelling probes and (according to some sources) Su-35-type radomes. Further pair ('503' and '504') built by mid-2001.

China ordered 38 KnAAPO-built Su-30MKKs and placed supplementary order (initially quoted as 24, but later known to be 38) in June 2001. First batch of 10 Su-30MKKs left Russia on delivery to China on 20 December 2000; nine followed in March/April 2001 and 10 more on 21 August. Later Chinese aircraft, known as Series III, will switch to Zhuk-MS radars. Russian weapon deliveries began in January 2001 with Kh-59ME (AS-18 'Kazoo'), Kh-29T (AS-14 'Kedge') and Kh-31P (AS-17 'Krypton') ASMs and KAB-500Kr guided bombs. Early Su-30MKKs variously reported with 'Three Swords' Air Regiment at Yuxikou, near Nanjing or at Wuhu, Anhui; those delivered in August 2001 were supplied to Cangzhou, Hebei. Chinese local assembly of Su-30MKK (possibly as J-13) was once expected, but now in doubt.

Su-30MKK2: First shown at MAKS, Moscow, August 2003; optimised for naval operations; development work undertaken by some of four retained Chinese Su-30MKKs ('501' to '504'). Improved precision attack capability and expanded command and control potential. Implied capability with Kupol (unconfirmed) M400 reconnaissance pod (carrying various options including SLAR, TV or LOROP); and UOMZ Sapsan-E electro-optic/laser targeting pod. Improved version of NIIP N001VE radar (simultaneous aerial engagements and ground mapping). Other weapons include Kh-31A, Kh-29T/EE/L, KAB-500Kr/1500Kr, R-27, R-73 and RVV-AE, while Chinese PL-12 first noted in 2006. Deliveries began (six aircraft) February 2004.

Su-30MKK3: Further Chinese variant for naval use; deliveries said to have been due from 2005. MTOW 38,000 kg (83,775 lb); NIIP Zhuk-MSE radar; Kh-59ME and Kh-31A anti-ship missiles. Initial order for 24 aircraft. No evidence of delivery.

Su-30MKM: Malaysian version; USD900 million contract initialled 19 May 2003. Manufacture by Irkut; deliveries from mid-2006, for completion by end of 2007. Generally as Su-30MKI, but Avionics of South Africa contracted in April 2004 to supply 18

multisensor warning systems comprising MAW-300 missile approach warners, IWS-310 laser warners and associated control systems, Elint system, jammer and chaff/flare systems of Russian manufacture. Both avionics changes remove Israeli equipment of Su-30MKI. Other items include Thales wide angle HUD, LCDs and thermal imaging pod; Sagem Sigma 95 navigation system; Russian helmet-mounted sight with Ukrainian Sura-M designator; plus Russian weapons already procured for Malaysian MiG 29s (R-73E and R-77).

CUSTOMERS: Indian Air Force initial USD1.8 billion order for 40 signed 30 November 1996; deliveries from Irkutsk began to No. 24 'Hunting Hawks' Squadron at Pune in March 1997; declared operational 11 June 1997; 10 more ordered September 1998, increasing total to 50, including 18 unmodified Su-30Ks for training. First MKIs to 20 'Lightning' Squadron in May 2002. Final deliveries in December 2004. Option taken up on licensed production of 140 more by HAL, India; however statement of November 2002 noted IAF had reduced quantity to 120, but this later discounted. In 2006, Russian sources predicted completion of 140th Indian-built Su-30 in 2012; to facilitate this, early kit deliveries will be in a more advanced state of assembly than previously planned.

On 29 August 1997, Indonesia signed for eight 'single-seat Su-30s' and four two-seat, but this was cancelled on 9 January 1998. Interest reportedly renewed in 2001, and in 2003 plan to acquire 48 of 'Flanker' family was announced, initial purchase being two each of Su-27 and Su-30. Malaysia ordered 18 on 19 May 2003 and Vietnam contracted for four (plus eight options) on 3 December 2003, the four Vietnamese delivered in December 2004.

Thailand reported in December 2005 to have reached preliminary agreement on purchase of 12 aircraft similar to Malaysian version. Algeria ordered 28 in March, while Venezuelan contract for 30 announced 21 July 2006.

COSTS: Indian aircraft quoted as USD20 million each (flyaway, 1998), with USD8 million extra per aircraft to integrate Indian-specific systems and avionics. Chinese order for 40 Su-30MKKs valued at USD1.5 billion (2002). Algerian contract for 28 valued at USD1.2 billion (2006).

Description refers to two-seat Su-30MK which generally as for Su-30, except as follows:
DESIGN FEATURES: Improvement on combat capabilities of Su-30 by compatibility with high-precision guided air-to-surface weapons with standoff launch range up to 65 n miles (120 km; 75 miles), in addition to Su-30's ability to engage two airborne targets simultaneously.

POWER PLANT: Two Saturn/Lyulka AL-35F turbofans, each 123 kN (27,558 lb st).

AVIONICS: In addition to standard Su-30 systems, Su-30M has more accurate navigation system, a TV command guidance system, a guidance system for anti-radiation missiles, a larger monochrome TV display system in rear cockpit for ASM guidance, and ability to carry one or two pods, typically for laser designation or ARM guidance in association with Pastel RWR and APK-9 datalink. Western avionics, guidance pods and weapons can be fitted optionally. Sextant Avionique package for Indian aircraft includes VEH3000 or Elop HUD, Totem or Sigma 95N/MF INS/GPS and liquid-crystal multifunction displays (six 127 × 127 mm; 5 × 5 in MFD 55 and one 152 × 152 mm; 6 × 6 in MFD 66 per aircraft).

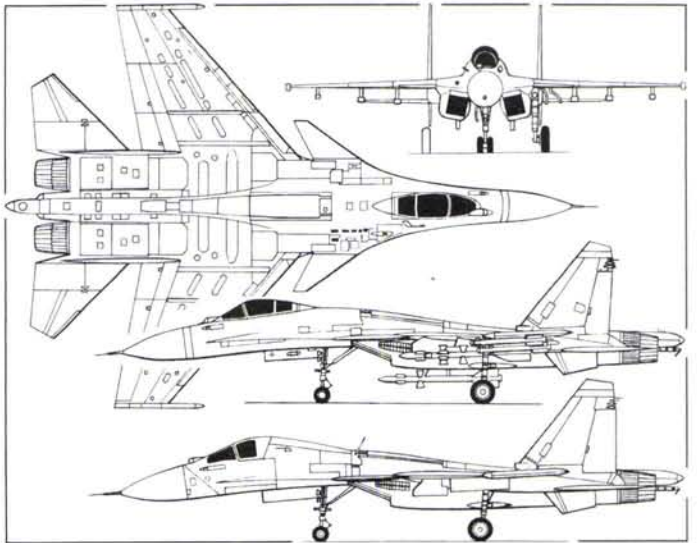
ARMAMENT: One 30 mm GSh-301 gun, with 150 rounds; 12 external stations for 8,000 kg (17,635 lb) of stores, including FAB-250, FAB-500, OFAB-250 270, OFAB-100-120 and

SU-30M PROTOTYPES AND PRODUCTION

Batch	Qty	Identity	Remarks
-	(1)	'56'; later '01'	Lost 12 June 1999
-	(1)	06	Previously T10PU-6
Algeria	28		Ordered 2006; deliveries from Irkutsk between 2008 and 2009
MKA			
China			
MKK	4	501-504 Trials aircraft; apparently not part of contract	
MKK	38	'01'-'38'	Ordered 1999, Delivered 2000-01 from Komsomolsk
MKK	38	'39'-'76'	Ordered June 2001; delivered 2002-03
MKK2	28	'01'-'28'	Ordered January 2003; delivered from January 2004
India			
MKI	4	'02' - '05'	Development, built 2000-01
MKI	10	SB019-028	Delivered from Irkutsk 20 May 2002
MKI	12	SB029-040	Delivered from Irkutsk October to December 2003
MKI	10	SB041-048	Delivered from Irkutsk in December 2004
MKI	18		Replacements for Su-30s returned to Irkutsk; deliveries from 2008
MKI	140		Production in India from 2007
Indonesia			
MK	2	TS-3001	Delivered August 2003
MK	2		On order from Komsomolsk
Malaysia			
MKM	18		Deliveries 2007-09 from Irkutsk
Venezuela			
MK	30		On order
Vietnam			
MK2	4		Deliveries December 2004 from Komsomolsk

guided KAB-500KR and KAB-1500KR bombs; B-8M-1 (20 × 80 mm), B-13L (5 × 130 mm) and O-25 (single 266 mm) rocket packs; up to six R-27ER (AA-10C 'Alamo-C'), R-27ET (AA-10D 'Alamo-D') or RVV-AE (R-77: AA-12 'Adder') medium-range AAMs; or two R-27ETs and six R-73E (AA-11 'Archer') IR homing close-range AAMs; and a variety of air-to-surface weapons such as four ARMs, six guided bombs or short-range missiles with TV homing, six laser homing short-range missiles, or two long-range missiles with TV command guidance; these include Kh-29L/T (AS-14 'Kedge'), Kh-31A/P (AS-17 'Krypton') and Kh-59M; (AS-18 'Kazoo') with APK-9 pod.

DIMENSIONS, EXTERNAL:	As Su-27 except:
Height overall	6,355 m (20 ft 10¼ in)
WEIGHTS AND LOADINGS (Su-30MK):	
Weight empty	17,700 kg (39,022 lb)
Max external weapon load	8,000 kg (17,637 lb)
Max internal fuel weight	9,640 kg (21,253 lb)
T-O weight: normal	24,960 kg (55,027 lb)
max	34,500 kg (76,059 lb)
overload	38,800 kg (85,539 lb)
PERFORMANCE (Su-30MK):	
Max level speed: at height	(1,144 kt; 2,120 km/h; 1,317 mph)
at S/L	M1.14 (729 kt; 1,350 km/h; 839 mph)
Max rate of climb at S/L	13,800 m (45,275 ft)/min
Service ceiling	17,300 m (56,760 ft)
T-O run, normal weight	550 m (1,805 ft)
Landing run with parachute	750 m (2,460 ft)
Combat range: internal fuel	1,620 n miles (3,000 km; 1,865 miles)
with one in-flight refuelling	2,805 n miles (5,200 km; 3,230 miles)
g limit	+9



Sukhoi Su-33 single-seat carrierborne fighter, with additional side view (lower) of two-seat Su-33UB operational trainer (James Goulding) 1159578

do not fold, since they reach only as far as the new outboard wing fold. Double slotted flaps, unslotted, 'adaptive' leading-edge, arrestor hook, datalink and carrier landing system. However, compared with Su-27IB, forward fuselage is slightly narrower, with seats closer together and has much less pronounced dorsal hump. New 'glass cockpit' with five colour LCD displays (one 53 cm; 21 in diagonally; rest 38 cm; 15 in) with provision for central or sidestick and with helmet-mounted sighting system. Aircraft has OBOGS and OBIGGS and so does not need oxygen or nitrogen bottles, N014 solid-state, phased-array radar, with enhanced air-to-ground and over-water capabilities, planned eventually, but prototypes have ballast or Zhuk-MS and production aircraft may initially use NIIR N610-27 (Zhuk 27); circular-section radomes replace flattened 'platypus' nose associated with Su-27IB. Su-33UB has new wing which is 12 per cent larger in span (16.40 m; 53 ft 9¾ in) and area (71.40 m²; 768.5 sq ft), as are the canards and tailplanes. Production Su-27KUB will feature a higher set, square-section, lengthened tail-sling, possibly mounting rear warning radar; tailcone folds (upwards) to reduce stowed length; prototypes have the standard Su-33 tailcone.

SUKHOI Su-34

NATO reporting name: Fullback
Export designation: Su-32
Design bureau designation: Su-27IB
TYPE: Attack fighter.
PROGRAMME: Side-by-side two-seat long-range fighter-bomber (*istrebitel bombardiroshchik*) Su-27 variant intended as tactical strike/attack replacement for Su-24 and Su-25; project designation T10V; redesignated Su-34 by Sukhoi ("to stress father-and-son relationship" to Su-24), but Russian Air Forces retained Su-27IB until late 2003, when Su-34 adopted, with Su-32 reserved for export. Su-32FN/Su-32MF assigned to proposed export versions but, in 2000, all Su-34s were redesignated Su-32.
Conceptual design ordered 21 January 1983, production authorised 19 June 1986, Designed under the direction of Rollan Martirosov. Prototype (T10V-1 '42') built in Sukhoi's own workshops and first flown 13 April 1990; first seen in Tass photograph showing this aircraft approaching (but not landing on) the carrier *Admiral of the Fleet Kuznetsov*; described as deck landing trainer, but no wing folding or deck arrestor hook; although with foreplanes and twin nosewheels like Su-27K. Designation Su-27KU quoted, though dedicated side-by-side carrier trainer then officially known as T10KM-2 or Su-27KM-2 for which the new side-by-side cockpit had been designed. Russian unofficial name 'Platypus'; exhibited to Russian Federation and Associated States (CIS) leaders at Machulishche airfield, Minsk, February 1992, with simulated attack armament on 10 external stores pylons (under each intake duct, on each wingtip, three under each wing);



Prototype Sukhoi Su-33UB (Yefim Gordon)

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Cockpit of Sukhoi Su-34

1158620



Lavatory and cockpit access of Sukhoi Su-34

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Kh-31A/P (AS-17 'Krypton') ASMs under ducts, R-73A (AA-11 'Archer') AAMs on wingtips; a 500 kg laser-guided bomb inboard, TV/laser-guided Kh-29 (AS-14 'Kedge') ASM on central pylon and RVV-AE (R-77; AA-12 'Adder') AAM outboard under each wing.

Production originally planned for Irkutsk, but eventually located at Novosibirsk. First series production aircraft flew 28 December 1994, although apparently second airframe, first having been delayed for equipment installation. Four were in assembly at Novosibirsk by early 1997. Twelve were once scheduled for delivery by 1998; intention was to replace all Su-24s by 2005; reconnaissance and electronic warfare versions reportedly under development. In September 2000, following increase in funding, Russian Air Forces C-in-C predicted first Su-32 deliveries in 2004, although by early 2002 this had slipped further to "after 2005". Statement of August 2003 indicated delivery between 2006 and 2010 of "a batch" of aircraft to Russian Air Forces, perhaps numbering "several dozen", although first receipts in 2005 or 2006, intended to be 10 aircraft of which half to go to bomber regiment in Chita region of Siberia (possibly 48th Division of 14th Air Force). In April 2005, Novosibirsk plant confirmed first production batch of five to be in hand. Senior officials, speaking in April 2006, predicted arrival of first two production aircraft before end of that year and completion of first regiment of 24 by 2010. Delivery of initial order for 18 contracted as two in 2006, six in 2007 and 10 in 2008; further orders intended to follow at 10 per year, giving fleet of 58 before 2015.

In mid-2001, Sukhoi predicted completion of State testing of Su-32 by end of 2001, using five aircraft based at Akhtubinsk and Zhukovsky. Trials tempo intensified in 2002, work including tests of Sh141 mission avionics suite as replacement for earlier systems found to have been unsatisfactory. However, first phase of State Tests not completed until mid-2003, when second phase begun; this involved three aircraft at Akhtubinsk test centre and four at Zhukovsky. Precision weapon trials, 2004, including bombing with use of Platran E-O system.

Side-by-side cockpit to form basis of proposed Su-30-2 long-range interceptor and Su-33UB (Su-27KUB) carrier trainer.

First production Su-34 rolled out at Novosibirsk on 6 July 2006; this and second earmarked for Chkalov flight test centre at Lipetsk. On 15 June 2006 Air Forces' C-in-C announced selection of AL-31F-M1 engine for production Su-34s.

CURRENT VERSIONS (specific): **T10V-1 '42'**: First flying prototype; detailed above. Converted from Su-27UB airframe by Sukhoi OKB workshops, with new nose built at Novosibirsk, and reportedly fitted with Su-33 main landing gear.

T10V-2 '43': Flown 18 December 1993; first aircraft to be built at Novosibirsk; introduced twin mainwheel bogies. Sometimes described as first production Su-34, in that it had Su-35-type four-hardpoint wing panels and larger internal fuel cells, reinforced wing centre-section, new main landing gear and fixed-geometry engine air intakes. However, Sukhoi now identifies this aircraft as Su-32 prototype, designed to meet Russian Air Forces requirement of 1998.

T10V-3: Static test airframe.

T10V-4 '44': First flown late 1996. Reported at Leninets radar plant, Pushkino, early 1997; first with full avionics and weapons systems, except EW package. Exhibited at Paris Air Show, June 1997. Also became known as Su-32.

T10V-5 '45': First Su-27UB with full Leninets mission avionics fit. Sometimes described as first series-produced T10V. First flew 28 December 1994.

T10V-6 '46': First flown January 1998. Being upgraded in 2005 to full production standard, matching T10V-8.

T10V-7 '47': First flown 22 December 2000. Shown at Moscow in August 2003. Being upgraded in 2005 to full production standard, matching T10V-8.

T10V-8 '48': "First flight" 20 December 2003, but may have flown shortly before. Confirmed as fifth built at Novosibirsk. Full range of avionics and sensors. Shown at Moscow Salon, August 2005.

CURRENT VERSIONS (general): **Su-27R**: Proposed version to replace Su-24MR and MiG-25RB in tactical reconnaissance roles, BKR (*bortovoi kompleks razvedki*; onboard reconnaissance complex) suite expected to include nose-mounted Pika SLAR and ESM, electro-optical, laser and IRLS reconnaissance equipment.

Su-27IBP: Proposed tactical jammer to replace Yak-28PP and Su-24MP.

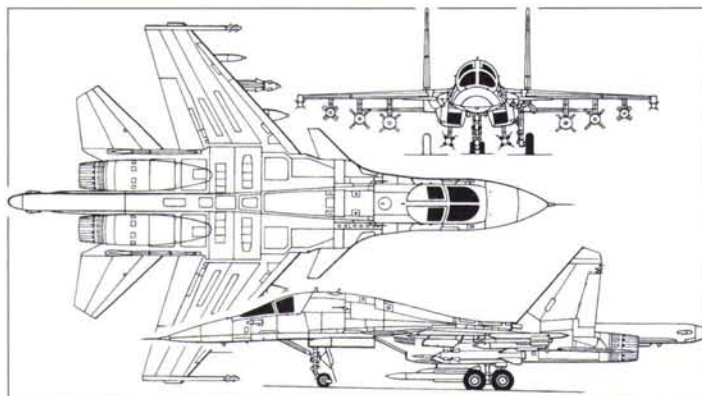
'Su-27IB Interceptor': Proposed ultra-long endurance combat air patrol variant. OKB's internal designation not known. May be confused reference to Su-33UB-based Su-30K-2 project.

Su-32: Export version. Clearance for marketing was expected in 2006.



Sukhoi Su-34 T10V-8, fifth Novosibirsk-built (Yefim Gordon)

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Sukhoi Su-27IB twin-turbofan theatre bomber (Mike Keep)

1159580

AVIONICS: Radar: Leninetz B004 multifunction phased-array radar with high resolution; rearward-facing radar in tailcone.
Instrumentation: Colour CRT, multifunction displays and helmet-mounted sight for pilot and navigator.
Mission: Built-in UOMZ EO IRST sighting system with TV and laser channels, optimised for air-to-ground use. Separate Geofizika podded thermal imaging system planned. New Argon main computer. Sorbtsya active ECM jamming pods under test on Su-27IB prototype 1995.
Self-defence: TsNIRTI electronic warfare system.

ARMAMENT: One 30 mm GSh-301 gun with 150 rounds. Twelve pylons for high-precision self-homing and guided ASMs, comprising Kh-59ME Ovod, Kh-31P/Kh-31A(P) (AS-17 'Krypton'), Kh-29T/TE/L (AS-14 'Kedge') and Kh-41/3M80 Moskit; and KAB-500 and KAB-1500 laser-guided bombs with ranges of 0 to 135 n miles (250 km; 155 miles); R-27 (AA-10 'Alamo'), R-73 (AA-11 'Archer') and RVV-AE (R-77; AA-12 'Adder') AAMs.

DIMENSIONS, EXTERNAL:
Wing span 14.70 m (48 ft 2 3/4 in)
Wing aspect ratio 3.5
Foreplane span 6.40 m (21 ft 0 in)
Length (without probe) 23.335 m (76 ft 6 3/4 in)
Height overall 6.50 m (21 ft 4 in)
Wheel track 4.40 m (14 ft 5 1/4 in)
Wheelbase 6.60 m (21 ft 7 3/4 in)

AREAS:
Wings, gross 62.00 m² (667.4 sq ft)
WEIGHTS AND LOADINGS (Su-32):
Max external stores 8,000 kg (17,637 lb)
T-O weight: normal 38,240 kg (84,304 lb)
max 44,350 kg (97,774 lb)

PERFORMANCE:
Max speed:
at height M1.8 (1,025 kt; 1,900 km/h; 1,180 mph)
at S/L M1.14 (756 kt; 1,400 km/h; 870 mph)
Service ceiling 15,000 m (49,220 ft)
Combat radius (internal fuel):
hi-hi-hi 594 n miles (1,100 km; 683 miles)
lo-lo-lo 324 n miles (600 km; 372 miles)
Range with max internal fuel 2,159 n miles (4,000 km; 2,485 miles)

SUKHOI Su-35 and Su-37 (Su-27SM2)
NATO reporting name: Flanker
TYPE: Multirole fighter.
PROGRAMME: Development of Su-27M authorised on 29 December 1993 by Council of Ministers. Experimental version of Su-27 with foreplanes (T10-24) flew May 1985; improved FBW system and refuelling probe tested by T10U-2. Five prototypes produced by conversion of production Su-27s, retaining single nosewheel and standard tailfins: T10M-1 '701' (ex-1602), then lacking radar and weapon control system (successively T10S-70, T10M, Su-27M, Su-35) flew 28 June 1988; T10M-2 flown 18 January 1989; T10M-5, T10M-6 '706' and T10M-7 '707'; used mainly by NII VVS at Akhtubinsk, flown by service pilots.
Production at KnaAPO, Komsomolsk, beginning with static test airframe T10M-4; first flight (T10M-3 '703') 1 April 1992; latter exhibited at 1992 Farnborough Air Show. Of further six ordered (T10M-8 to 13; '708' to '713'), final aircraft was cancelled. NII P N011M Bars phased-array radar tested in '711' and '712'. Large-scale series production originally planned 1996–2005 as interim fighter pending availability of (also cancelled) Mikoyan MFI.

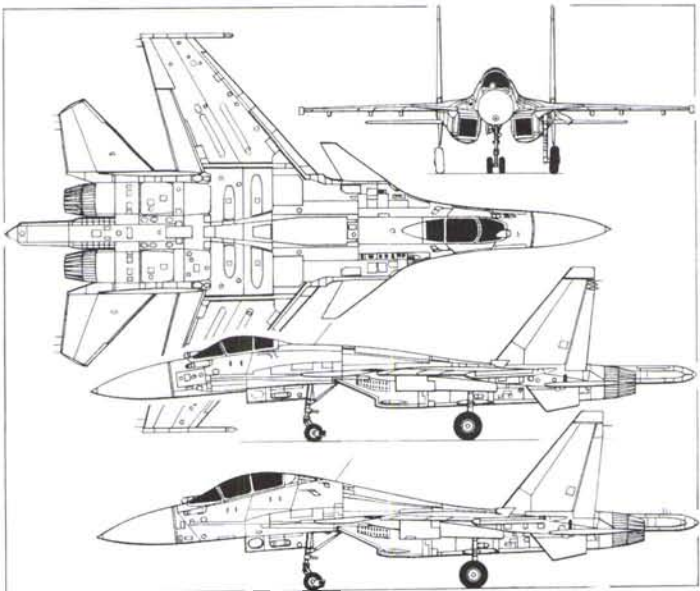
Three production aircraft (Blue 86, 87 and 88) delivered to Akhtubinsk from Komsomolsk in 1996 or 1997. In November 2002 it was announced that six Su-35s would be delivered to 237th Aviation Display Regiment (*Russian Knights*) at Kabinka, Moscow. These delivered August 2003. In October 2005, Sukhoi general director announced launch of further Su-35 production at Komsomolsk in 2006. Air Forces' plans being for receipt of 24 by 2010. These expected to have AL-31F-M1 engines, but agreement of 8 June 2006 covered development of upgraded engine (*Izdelie* 117C) by Sukhoi OKB (40 per cent funding), Saturn and UMPO (30 per cent each).

KnaAPO revealed in 2001 that production Su-35s and Su-35UBs will have thrust vectoring AL-31FP engines, thereby negating Su-37 designation.

CURRENT VERSIONS: **Su-35:** (Flanker-E Variant 1): Designation Su-27SM2. Baseline single-seater; as described.

Su-35UB: Two-seat (tandem) derivative of the Su-35 with same FCS, canard foreplanes, tall square-topped tailfins, 12-pylon wing, Zhuk main AI radar and N012 rearward-facing, tailcone-mounted radar. Developed as a demonstrator and trainer for the Su-35, the construction of the prototype (Blue 801) at Komsomolsk may have been prompted by the needs of Sukhoi's campaign to sell the Su-35 to South Korea. The aircraft first flew on 7 August 2000 and was reported to be undergoing trials at Akhtubinsk in October 2000. Has 123 kn (27,558 lb st) AL-31FP (AL-31F) thrust-vectoring engines.

Su-35UB has 38,800 kg (83,775 lb) MTOW; 8,000 kg (17,637 lb) combat load; 12,400 litres (3,276 US gallons; 2,728 Imp gallons) internal fuel load; 1,090 kt (2,020 km/h; 1,255 mph) max speed; 1,619 n mile (3,000 km; 1,864 mile) unrefuelled range; wing span



Sukhoi Su-35 single-seat counter-air and ground attack fighter, with additional side view (lower) of Su-35UB (James Goulding) 1159579

14.70 m (48 ft 2 3/4 in); length overall 21.94 m (71 ft 1 1/2 in) (shorter tailboom); and height overall 6.355 m (20 ft 10 3/4 in).

Su-37: (Flanker-E Variant 2) Technology demonstrator for proposed production fighter resulting from vectored-thrust programme of the Su-27UB-PS, Su-27UBL, Su-27LMK No. 2405 and the penultimate prototype Su-35 ('711') which made its first flight, with nozzles fixed, on 2 April 1996 (or 12 April, according to some sources). This aircraft had previously been first of two N011M radar testbeds, flying in blue/grey camouflage. Designated Su-37 by Sukhoi bureau. By September 1996, when demonstrated at Farnborough Air Show (Western debut), in tropical camouflage, '711' had made 50 flights with hydraulically actuated nozzles able to move ±15° in pitching plane at rate of 30°/s under control of aircraft's flight control system. Probably toed-out 32° from the centreline, like Su-30 MKI, generating powerful yawing moment when actuated differentially. An emergency pneumatic system returns the nozzles to level flight setting in the event of system failure.

Any production Su-37 was expected to feature uprated AL-31FU engines (142.2 kN; 31,967 lb st). In 1999, Sukhoi was using designation Su-37MR for proposed production version, apparently reflecting a major avionics upgrade then under way. By 2001, '711' had been retrofitted with non-vectoring AL-31F engines, revised Ramenskoye instrumentation and a new flight control system which was stated to provide TV-type agility without recourse to vectoring; used in trials for Indian Su-30MKI Stage 3.

Second Su-37 reportedly converted from T10M-12 and first flew in mid-1998, initially powered by AL-31F; installation of thrust-vectoring AL-37FPs was expected in late 1998; status of this aircraft, if still extant, remains unclear. Development of AL-31F engine being undertaken unilaterally by MMPP Salyut, version promising 10 to 15 per cent extra thrust having first flown on 24 January 2002 (on Su-27 testbed and lacking Klivit thrust vectoring nozzle).

Su-37 "Terminator": In November 2003, Sukhoi announced that it is developing an upgraded version of Su-37, with capabilities equivalent to a "4++" generation fighter, as a means to securing further export orders before the next-generation Su-47 is available in 2010-12. AL-31F engines, although AL-41F also quoted in relation to **Su-35BM**, which appears to be an alternative designation.

T-50: Design under way by mid-2005 for offer to Russian Air Forces as interim fighter, pending availability of PAKFA in 2015, or later. Preliminary work due for completion in 2006; based on Su-35, but with later standard of avionics.

CUSTOMERS: Once scheduled for entry into Russian Air Forces service as Su-27M from 1995 onwards, for effective operation until 2015–2020; programme in suspension. Indonesia announced imminent purchase in March 2003 of two Su-35s and two Su-27s, to be followed over four years by further 44 'Flankers' of undisclosed type.

COSTS: Estimated USD35 million to USD40 million (2002).

DESIGN FEATURES: Advanced multirole development of Su-27 to counter latest versions of USAF F-15 Eagle and F-16 Fighting Falcon, with better dogfighting characteristics, higher AoA limits, lighter weight and new BVR armament; proposed to include 216 n mile (400 km; 248 mile) range AAM-L (one AAM-L contender was Novator KS- 172). Also planned to have greater autonomy from GCI control. Airframe, power plant, avionics and armament all upgraded; quadruplex digital fly-by-wire controls under development by Avionika, though prototypes retain analogue system; longitudinal static instability; 'tandem triplane' layout, with foreplanes; double-slotted flaperons; taller, square-tip twin tailfins with integral fuel tanks; reprofiled front fuselage for larger-diameter radar antenna; enlarged

Su-35 PROTOTYPES AND PRODUCTION			
Batch	Qty	Identity	Remarks
-	(1)	T10M-1 '701'	Previously Su-27 1602
-	(1)	T10M-2 '702'	Previously Su-27
-	(1)	T10M-5 '705'	Previously Su-27
-	(1)	T10M-6 '706'	Previously Su-27
-	(1)	T10M-7 '707'	Previously Su-27
10	1	T10M-4	Static test airframe
10	1	T10M-3 '703'	First Komsomolsk-built; 237th Regiment '1'
11	1	T10M-8 '708'	
11	1	T10M-9 '709'	
11	1	T10M-10 '710'	
11	1	-	Static test airframe
11	1	T10M-11 '711'	Converted to Su-37; reverted to Su-35; crashed 19 December 2002
12	3	'86' et seq	Production; to 237th Regiment as '3' to '5'
n/k	1	T10M-12 '712'	Radar testbed; 237th Regiment '2'
n/k	1	'801'	Su-35UB

Notes: Former Su-27 aircraft may include 2209 and 2219; numbers '716' and '717' assigned to an Su-30MKI and Su-33UB, respectively



Prototype Sukhoi Su-35UB (Yefim Gordon)

1158634

tailcone for rearward-facing radar; twin-wheel nose landing gear; axisymmetric thrust-vectoring nozzles under development for use on production aircraft (see Su-37).

STRUCTURE: Higher proportion of carbon fibre and aluminium-lithium alloy in fuselage; composites used for components such as leading-edge flaps, nosewheel door and radomes.

POWER PLANT: Two Saturn/UFA 117C versions of AL-31F turbofan, each 142.2 kN (31,970 lb st) with afterburning; prototypes retain standard AL-31F. Increased internal tankage through use of welded aluminium-lithium tanks and new tanks in tailfins and finroots. Total fuel capacity 12,900 litres (3,408 US gallons; 2,838 Imp gallons). Retractable flight refuelling probe on port side of nose.

ACCOMMODATION: Pilot(s), on Zvezda K-36D-3.5E zero/zero ejection seat, this now angled back 30°.

AVIONICS: *Radar:* Originally planned to incorporate NIIP N011 Zhuk-27 multimode low-altitude terrain-following/avoidance radar. By 2006, NIIP Irbis being phased-array radar predicted as equipment of production version. N012 rearward-facing radar, range approximately 2 n miles (4 km; 2.5 miles), may enable firing of rearward-facing IR homing AAMs. N011 and N012 constitute RLSU-27 system.

Flight: Fully automatic flight modes and armament control against ground, maritime and air targets, including automatic low-altitude flight and automatic target designation. RPKB nav system includes laser-gyro INS and Glonass GPS.

Instrumentation: Two-seat variant has side-by-side MFI-10-5 screens and HUD in front cockpit; vertically stacked MFI-10-5 screens in rear.

Mission: New-typeIRST moved to starboard; small external TV pod; all combat flight phases computerised. Shown at Farnborough with GEC-Marconi TIALD (thermal imaging airborne laser designator) night/adverse visibility pod fitted for possible future use.

Self-defence: Entirely new integrated EW suite with ECM, including active jammer and wingtip Sorbtsa-S G- or J-band ECM/ESM pods; Pastel RWR; Mak IR-based MAWS.

ARMAMENT: One 30 mm GSh-30 gun in starboard wingroot extension, with 150 rounds. Mountings for up to 14 stores pylons, including R-27 (AA-10 'Alamo-A/B/C/D'), R-40 (AA-6 'Acrid'), R-60 (AA-8 'Aphid'), R-73E (AA-11 'Archer') KS-172S-1 and RVV-AE (R-77; AA-12 'Adder') AAMs, Kh-25ML (AS-10 'Karen'), Kh-25MP (AS-12 'Kegler'), Kh-29T (AS-14 'Kedge'), Kh-31P (AS-17 'Krypton') and Kh-59 (AS-18 'Kazoo') ASMs, S-25LD laser-guided rockets, S-25IRS IR-guided rockets, GBU-500L and GBU-1500L laser-guided bombs, GBU-500T and GBU-1500T TV-guided bombs, KMGU cluster weapons, KAB-500 bombs, rocket packs and BrahMos supersonic cruise missile. Maximum weapon load 8,200 kg (18,077 lb).

DIMENSIONS, EXTERNAL:

Wing span over ECM pods	15.16 m (49 ft 8¾ in)
Wing aspect ratio	3.5
Length overall	22.185 m (72 ft 9½ in)
Height overall	6.36 m (20 ft 10¼ in)

AREAS:

Wings, gross	62.04 m² (667.8 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	17,000 kg (37,479 lb)
Max fuel weight	10,250 kg (22,597 lb)
Max combat load	8,500 kg (18,739 lb)
T-O weight: normal max	34,000 kg (74,957 lb)
overload	38,800 kg (85,539 lb)
Max wing loading (normal)	548.4 kg/m² (112.32 lb/sq ft)
Max power loading (normal)	139 kg/kN (1.36 lb/lb st)

PERFORMANCE:

Max level speed:	
at height	M2.35 (1,350 kt; 2,500 km/h; 1,555 mph)
at S/L	M1.14 (756 kt; 1,400 km/h; 870 mph)
Service ceiling	17,200 m (56,440 ft)
Balanced runway length	1,200 m (3,940 ft)
Range: with max internal fuel	1,835 n miles (3,400 km; 2,112 miles)
with flight refuelling	3,401 n miles (6,300 km; 3,914 miles)
g limit	+9

SUKHOI I-21 PAKFA

TYPE: Multirole fighter.

PROGRAMME: Successor programme to original quest for fifth-generation fighter, for which MiG 1.42 and Sukhoi S-37/Su-47 Berkut demonstrators were built. Development began in 1998 to meet Russian Air Forces TTZ (tactical technical assessment) of the same year. Sukhoi-led co-operative project launched May 2001; initially termed LFS (*legkiy frontovoy samolet*: Light Frontline Aircraft), although competition also known as LFI (*legkiy frontovoy istrebitel*: Light Frontline Fighter). Air Forces' project name is PAKFA (*perspektivnyi aviatsionnyi kompleks frontovoi aviatsii*: Prospective Aviation Complex for Frontal Aviation). In January 2006, Air Forces' C-in-C quoted designation I-21 for PAKFA, previous T-50 designation now being linked with upgraded Su-37 to function as interim fighter until service entry of PAKFA.

Examining committee established 10 January 2002 to assess competing bids from RSK 'MiG' and AVPK Sukhoi, each of which nominated Yakovlev as associate. On 26 April 2002, Russian Federation Ministry of Industry, Science and Technology declared Sukhoi as lead developer of new aircraft, to be assisted by RSK 'MiG' and Yakovlev as subcontractors. In May 2002, development agreement signed by AVPK Sukhoi, Sukhoi OKB, State Research Institute of Aviation Systems (Gos-NIIAS), Central Aero- and Hydrodynamic Institute (TsAGI), Research Institute of Aero Engine Technology and Production (TsIAM), Central Research Institute of Material (VIAM), National Institute of Aviation Technologies (NIAT), Lyulka/Saturn engine bureau, Ramenskoye Instrument Design Bureau (RPKB), Aviapribor holding company, Aviakosmicheskoye Oborudovaniye and Vypmel and Strela weapon companies. Several manufacturing plants expected to join at later stage. Participation of KnAAPO production plant was agreed in June 2002.

Timetable for PAKFA initially was draft design by end of 2002; first flight in 2006; production from 2010. Official funding equivalent to USD1.5 billion promised for R & D, but this considered inadequate, representing some 20 per cent of needs, excluding production investment. Unit cost expected to be USD35 million to USD40 million (2002 prices), based on production of between 500 and 600 aircraft. By early 2006, schedule had slipped to first flight in 2009 and, according to Air Forces' deputy C-in-C, first delivery in "2015 to 2016". Sukhoi had spent USD100 million on PAKFA by mid-2005.

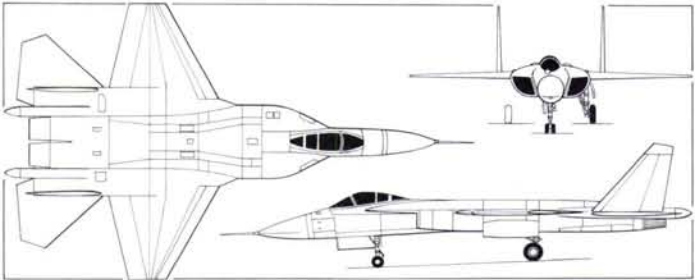
Parameters believed to include 20 tonne MTOW — between MiG-29 and Su-27 types it is due to replace — supersonic cruising speed, low observables, high manoeuvrability and short-field performance. In January 2006, Air Forces revealed that target max level speed had been reduced from Mach 2.15 to 2.0 to assist design. Engine choice yet to be made, but NPO Saturn is offering a derivative of AL-41F1, which was delivered to the Gromov test centre at Zhukovsky in November 2003 to be installed in a flight test aircraft. By November 2005, this Su-27M had flown nearly 30 sorties, initially with one, then with two test engines installed. Suggested that improved AL-31F will power initial PAKFAs, however.

In January 2003, India discussed terms of invitation by Russia to join PAKFA design team. Preliminary details and a probable configuration were unofficially circulating by mid-2003, showing an aircraft similar to the Su-47 Berkut, apart from more conventional wings. Reports of imminent agreement described in November 2005 as premature, although not dismissed.

During 2005, Russian Air Forces' C-in-C, Gen Vladimir Mikhailov, revealed preference for a high/low mix combining PAKFA with a lightened, single-engine version, which nevertheless almost identical in other aspects, including avionics. No funding is known for this project.

DIMENSIONS, EXTERNAL:

Wing span	15.5 m (51 ft)
Length overall	23.0 m (75 ft)



Provisional general arrangement of Sukhoi T-50 PAKFA (James Goulding)

0567236



Technology demonstrator Sukhoi Su-47 Berkut (Yefim Gordon)

1158646

WEIGHTS AND LOADINGS:	
T-O weight: normal	24,000 kg (53,000 lb)
max	33,000 kg (72,750 lb)
PERFORMANCE:	
Max level speed	M2.0
Supercruise speed	M1.6+
Radius of action	647 n miles (1,200 km; 745 miles)
Ferry range	2,159 n miles (4,000 km; 2,485 miles)

SUKHOI Su-29

TYPE: Aerobatic two-seat sportplane.
PROGRAMME: Announced at Moscow Air Show '90; design started 1990; construction of first of three prototypes and two static test airframes began 1991; prototype first flew 1991, first production aircraft May 1992; entered service July 1992, AP-23 type certificate awarded in 1994. Assessed by Russian Air Forces experimental centre at Akhtubinsk in 1996-97, but no orders placed.

Following structural failure of Su-29 wing in 1996, remedial manufacturing practices in place and recertified by 1998. Resumed civilian export production now featured M 14PF engine and new propeller, but M-9F engine introduced in 1999. Retrospective installation of SKS-94 pilot's emergency extraction system offered by Sukhoi from 2000.

Production transferred to LAPIK division of RSK 'MiG' (formerly LMZ) at Lkhovitsy from early 2001, earlier aircraft having been built by Sukhoi Advanced Technologies using components manufactured by LMZ, Dubna and others. Only one built in 2001. Six Su-29s and Su-31s reported under construction during 2004, although no reports of delivery up to mid-2006.

CURRENT VERSIONS: **Su-29:** Basic two-seat training/aerobatic aircraft.
Description applies to baseline Su-29.

Su-29AR: Aircraft for Argentina have German propeller, Swiss canopies and US wheel assemblies and avionics, including GPS.

Su-29KS: Development vehicle for Zvezda SKS-94 lightweight crew extraction system. Weight empty, equipped 800 kg (1,764 lb). First exhibited at 1994 Farnborough Air Show. One only (RA-01485); carries designation 'Su-29KS'.

Su-29M: Production version from 1999 (initial series of 10 under construction); M-9F engine; weights as Su-29; no extraction system.

Su-49: Proposed military trainer.

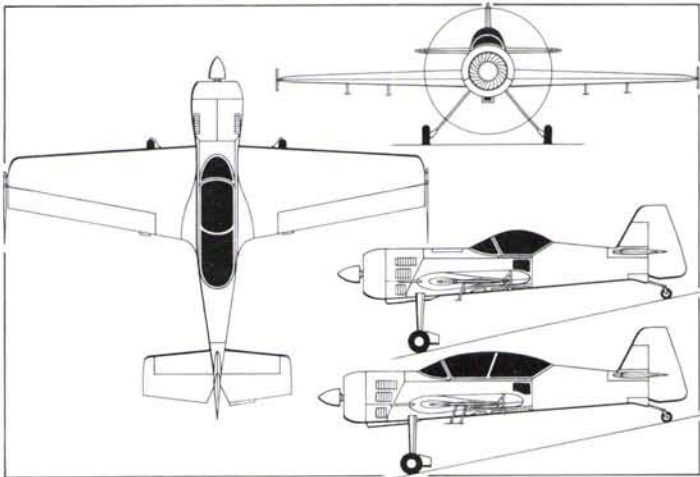
CUSTOMERS: Total 52 basic Su-29s and one Su 29KS built and sold by 1997; many exported to Pompano Air Center, Florida, USA, for reassembly and delivery worldwide (including eight in 1992; 12 in 1993; seven in 1994 and four in 1995); others to Australia (three), Italy, South Africa (two) and UK. Relunched production from 1999 (initial batch of 10). Eight ordered by Argentine Air Force, for training. March 1997: delivery between September 1997 and August 1998 to Escuadrilla Cruz del Sur (Southern Cross Squadron) based at Mendoza AFB. By mid-2001, Sukhoi had built 166 aerobatic light aircraft of the Su-26/29/31 series, of which all but 10 had been exported, including 80 to the USA. Sukhoi presented two to ruler of unspecified Gulf state, but these not used and eventually sold. Deliveries scheduled in 2002 to customers in the Czech Republic, Germany, Russia, South Korea and Switzerland were, apparently, not effected and there has been no known production since 2003.

COSTS: USD220,000 to USD260,000 (2002).

DESIGN FEATURES: Typical aerobatic competition aircraft; mid-wing of specially developed symmetrical section, variable along span, slightly concave in region of ailerons to increase their effectiveness; leading-edge somewhat sharper than usual to improve responsiveness to control surface movement. Two-seat development of Su-26M single-seat aerobatic competition aircraft; wing span and overall length increased; improved aerodynamics and reduced stability margin for enhanced manoeuvrability. Service life 1,250 hours.

Wing leading-edge sweepback 3° 28', symmetrical section, thickness/chord ratio 16 per cent at root, 12 per cent at tip, dihedral 0°, incidence 0°.

FLYING CONTROLS: Conventional and manual. Elevators and rudder horn-balanced; elevator trim; two suspended triangular balance tabs under each aileron. Later Su-29s have Su-31-type wing with ailerons extending to wingtips. No flaps.



Sukhoi Su-29 with additional side view (upper) of Su-31T (Mike Keep) 0015120

STRUCTURE: Composites comprise more than 60 per cent of airframe weight; one-piece wing, covered with honeycomb composites panels; foam-filled front box spar with CFRP booms and wound glass fibre webs; channel section rear spar of CFRP; titanium truss ribs; plain ailerons have CFRP box spar, GFRP skin and foam filling; fuselage has basic welded truss structure of VNS-2 high-strength stainless steel tubing; lower nose section of truss removable for wing detachment; quickly removable honeycomb composites skin panels; light alloy engine cowlings; integral fin and tailplane construction same as wings; rudder and elevator construction same as ailerons; titanium exhaust, battery box and firewall; forged magnesium control linkages. Aircraft assembled by Sukhoi from components produced by LMZ, Dubna (DMZ) and NPO Technologia (at Omsk).

LANDING GEAR: Tailwheel type; fixed. Fuselage-mounted spring titanium alloy cantilever mainwheel legs; mainwheels size 400x150, with hydraulic disc brakes; steerable tailwheel, on titanium spring, connected to rudder. Optional composites fairings for mainwheels.

POWER PLANT: One 265 kW (355 hp) VOKBM M-14PT or 294 kW (394 hp) M-14PF nine cylinder radial engine; three-blade MT-Propeller MTV-3-8-S/L250-21 or MTV-9-260 propeller. Current production employs VOKBM M-9F (M-14 derivative) rated at 309 kW (414 hp). Steel tube engine mounting. Fuel tank in fuselage forward of front spar; capacity 63 litres (16.6 US gallons; 13.8 Imp gallons); tank in each wing leading-edge; capacity 106.5 litres (28.15 US gallons; 23.4 Imp gallons); total fuel capacity 276 litres (72.9 US gallons; 60.6 Imp gallons); gravity fuelling. Oil capacity 20 litres (5.3 US gallons; 4.4 Imp gallons). Fuel and oil systems adapted for inverted flight; pneumatic engine starting system.

ACCOMMODATION: Pilot only for aerobatic competition, two persons in tandem for training. Canopy normally opens sideways to starboard; but upward and rearward in emergency to jettison. Dual controls standard. Space for 5 kg (11 lb) baggage in rear fuselage.

SYSTEMS: Electrical system 24/28 V, with 3 kW generator, batteries and external supply socket.

AVIONICS: *Comms:* Briz VHF radio; optional Becker or Bendix/King com/nav and Garmin GPS.

EQUIPMENT: Optional provision for smoke generation.

DIMENSIONS, EXTERNAL:	
Wing span	8.20 m (26 ft 10¾ in)
Wing chord: at root	1.985 m (6 ft 6¼ in)
at tip	1.04 m (3 ft 4¾ in)
Wing aspect ratio	5.5
Length overall	7.285 m (23 ft 10¾ in)



Sukhoi Su-29 competition/display aerobatics lightplane (Paul Jackson)

1121846

For details of the latest updates to *Jane's All the World's Aircraft* online and to discover the additional information available exclusively to online subscribers please visit jawa.janes.com



Sukhoi Su-29 two-seat sportplane (Yefim Gordon)

Height overall	2.885 m (9 ft 5 3/4 in)
Tailplane span	2.90 m (9 ft 6 1/2 in)
Wheel track	2.40 m (7 ft 10 1/2 in)
Wheelbase	5.08 m (16 ft 8 in)
Propeller diameter	2.50 m (8 ft 2 1/2 in)
Propeller ground clearance	0.425 m (1 ft 4 3/4 in)
DIMENSIONS, INTERNAL:	
Cockpit: Length	2.60 m (8 ft 6 1/4 in)
Max width	0.82 m (2 ft 8 1/4 in)
Max height	1.05 m (3 ft 5 1/4 in)
AREAS:	
Wings, gross	12.20 m ² (131.4 sq ft)
Ailerons (total)	2.32 m ² (24.97 sq ft)
Fin	0.28 m ² (3.01 sq ft)
Rudder	0.90 m ² (9.69 sq ft)
Tailplane	0.98 m ² (10.55 sq ft)
Elevators (total)	1.56 m ² (16.79 sq ft)
WEIGHTS AND LOADINGS (two persons):	
Weight: empty	735 kg (1,620 lb)
empty, equipped	780 kg (1,720 lb)
Max fuel	207 kg (456 lb)
Max T-O weight: pilot only	860 kg (1,896 lb)
two persons	1,200 kg (2,645 lb)
Max wing loading	98.4 kg/m ² (20.15 lb/sq ft)
Max power loading: M-14PT	4.53 kg/kW (7.45 lb/hp)
M-14PF	4.09 kg/kW (6.71 lb/hp)
M-9F	3.89 kg/kW (6.39 lb/hp)
PERFORMANCE (M-14PT engine):	
Never-exceed speed (VNE)	242 kt (450 km/h; 279 mph)
Max level speed	175 kt (325 km/h; 202 mph)
Landing speed	65 kt (120 km/h; 75 mph)
Stalling speed	62 kt (115 km/h; 72 mph)
Max rate of climb at S/L	960 m (3,150 ft)/min
Service ceiling	4,000 m (13,120 ft)
Max rate of roll	360°/s
T-O run	120 m (395 ft) ¹
Landing run	380 m (1,250 ft) ¹
Range with max fuel	647 n miles (1,200 km; 745 miles)
g limits	+12/-10

¹ at 914 kg (2,015 lb) A/UW

SUKHOI Su-31

TYPE: Aerobatic single-seat sportplane.
PROGRAMME: Design started 1991; prototype construction began 1992, flew June 1992 as Su-29T, demonstrated at 1992 Farnborough Air Show; followed by two more prototypes and two static test airframes; first production aircraft by Sukhoi Advanced Technologies (RA-01405) flown 1994. Su-31M2 introduced in 1999. Manufacture transferred to RSK 'MiG' (LAPIK at Lukhovitsy) in early 2001; two Su-31Ms, one Su-31 built in 2001.
In XXI World Aerobatic Championships, June 2001, Su-31s gained first place and seven of next 14 places.
CURRENT VERSIONS: **Su-31:** Basic version; non-retractable landing gear. Alternatively known as **Su-31T** (*Turnirnyi*: Competition). See Su-29 drawings for side view.
Su-31M: As Su-31T but with Zvezda SKS-94 pilot's extraction system under modified canopy with deeper frame. Empty weight 760 kg (1,676 lb); normal T-O weight 880 kg (1,940 lb). Prototype RA-01486 converted from Su-31T.
Su-31M2: Improved version of Su-31M with larger wing, airframe weight reduced by approximately 80 kg (176 lb), ergonomically redesigned cockpit, and upgraded Zvezda SKS-94M pilot's extraction system. Prototype scheduled to fly in mid-2003 but completion of engineering mockup was delayed to 2005. This expected to have VOKBM M-9F nine-cylinder radial of 294 kW (394 hp) in view of possible termination of M-14 production.
Su-31X: Export version of Su-31T.
Su-31U: As Su-31T but retractable landing gear. None yet built.



Sukhoi Su-31 flown by Jurgis Kairys (Paul Jackson)

Su-31ChM: Improved version of Su-31M2 under development in 2003 for World Aerobatic Championships competitions; features include airframe weight reduced by 25 kg (55 lb), and 313 kW (420 hp) VOKBM M-9F engine.
CUSTOMERS: Total 25 (including five Su-31Ms) built by late 1998 and exported to Australia, Brazil, Italy, Lithuania, South Africa, Spain, Switzerland, Ukraine, UK and USA. Su-31Ms operated in Italy, Russia and Switzerland. Production batch of five Su-31M2s, 1999-2000, of which at least two to USA: RSK 'MiG' to build initial batch of nine at its LAPIK division (three Su-29s and six Su-31s). Total of six Su-31s were scheduled for delivery in 2002, including two Su-31Ms for the Czech Republic and one Su-31M for a Swiss customer, but only known delivery was of Czech examples (OK-HXB and 'XC') in 2005, increasing total built to 31.
COSTS: USD220,000 to USD260,000 (2003).

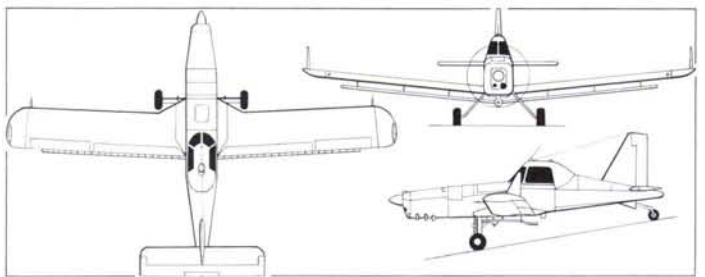
DESIGN FEATURES: Basically single-seat version of Su-29 with uprated engine; new landing gear; 35° inclination of seat enables pilot to employ repeatedly a g load of +12/-10, giving advantages in controlling aircraft within limited flying area and to perform very complicated manoeuvres; improved field of view; two baggage compartments.
STRUCTURE: More than 70 per cent composites by weight; centre-fuselage is welded truss of high-strength stainless steel tube, with detachable skin panels of honeycomb-filled composite sandwich; rear fuselage is semi-monocoque of composites with honeycomb filler; one-piece two-spar wing with carbon fibre main spar, titanium ribs, covered with honeycomb sandwich skin; tail unit is all-composites; mainwheel legs titanium.
LANDING GEAR: As Su-29.
POWER PLANT: One 294 kW (394 hp) VOKBM M-14PF nine-cylinder radial engine in Su-31T/M: MTV-9 three-blade propeller. Basic fuel capacity 78 litres (20.6 US gallons; 17.2 Imp gallons), in fuselage tank; provision in Russian version for 210 litre (55.5 US gallon; 46.2 Imp gallon) centreline drop tank for ferrying; alternatively, in export version, two tanks in wings, total capacity 200 litres (52.8 US gallons; 44.0 Imp gallons).
ACCOMMODATION: Pilot only; windscreen and separate canopy, opening as Su-29, except single-piece windscreen/canopy and pilot extraction system in Su-31M and Su-31M2.
DIMENSIONS, EXTERNAL (Su-31T):

Wing span	7.80 m (25 ft 7 in)
Wing chord: at root	1.99 m (6 ft 6 1/4 in)
at tip	1.04 m (3 ft 4 3/4 in)
Wing aspect ratio	5.2
Length overall	6.83 m (22 ft 4 3/4 in)
Height overall	2.76 m (9 ft 0 3/4 in)
Tailplane span	2.90 m (9 ft 6 1/2 in)
Wheel track	2.40 m (7 ft 10 1/2 in)
Wheelbase	4.90 m (16 ft 1 in)
Propeller diameter	2.50 m (8 ft 2 1/2 in)
Propeller ground clearance	0.425 m (1 ft 4 3/4 in)
AREAS (Su-31T): As Su-29 except:	
Wings, gross	11.83 m ² (127.3 sq ft)

WEIGHTS AND LOADINGS (Su-31T, except where otherwise indicated):	
Weight: empty	680 kg (1,499 lb)
empty, equipped: Su-31T	740 kg (1,631 lb)
Su-31M	750 kg (1,653 lb)
Max fuel: internal	53 kg (117 lb)
external	209 kg (461 lb)
T-O weight: normal	835 kg (1,841 lb)
max	968 kg (2,134 lb)
Max wing loading	82.0 kg/m ² (16.80 lb/sq ft)
Max power loading: Su-31T/M	3.25 kg/kW (5.34 lb/hp)
PERFORMANCE (Su-31T):	
Never-exceed speed (VNE)	243 kt (450 km/h; 280 mph)
Max level speed	178 kt (330 km/h; 205 mph)
Stalling speed	61 kt (113 km/h; 71 mph)
T-O speed	60 kt (110 km/h; 69 mph)
Landing speed	62 kt (115 km/h; 72 mph)
Max rate of climb at S/L	1,440 m (4,725 ft)/min
Service ceiling	4,000 m (13,120 ft)
Max rate of roll	400°/s
T-O run	110 m (360 ft)
Landing run	300 m (985 ft)
Range, internal fuel	156 n miles (290 km; 180 miles)
Ferry range	432 n miles (800 km; 497 miles)
g limits	+12/-10

SUKHOI Su-38L

TYPE: Agricultural sprayer.
PROGRAMME: Design started, as Su-38, under Boris Rakitin, August 1993; originally based closely on Su-29 sportplane; construction of prototype began January 1994 but curtailed due to financial situation in Russia. Promotion resumed in 1998, under S-38L designation and with considerable change of detail design, including replacement of VOKBM M-14P radial engine. Announced June 2000 that order signed to build prototype, now known as Su-38L. Prototypes fabricated by SmAZ; target of five complete (including two static test) aircraft by second quarter of 2002; first two under assembly at Sukhoi OKB workshops by September 2000. First flight (01) 27 July 2001; public debut at Moscow Salon, 14-19 August 2001, when 01 shown with (static) and without (flying) winglets and then unflown 02 exhibited statically. Compared with earlier drawings and mockup, prototypes have increased length due to additional fuselage plug ahead of wings. By June 2002 two (of three planned) prototypes had completed 60 missions of projected 100- to 150-sortie flight programme, intended to lead to initial certification in September or October 2003. Third prototype's maiden flight delayed from August 2002 to end 2002/early 2003. Initial



Sukhoi Su-38L agricultural aircraft (James Goulding)



Prototype Sukhoi Su-38L (Yefim Gordon)

0576509

production by SmAZ with target of 20 in 2003, rising to 40 in 2004, and potential for up to 100 aircraft per year. Second production line intended by Razdanmash AOZT of Armenia, subject to acquisition of US\$23 million for flight test and tooling. By August 2006 no further progress reports had been received.

CUSTOMERS: Estimated market for 500 in Russia.

COSTS: Unit cost USD100,000 to USD150,000 (2002); direct operating cost USD300 per hour (2001).

DESIGN FEATURES: Conventional low-wing monoplane. Constant-chord wings swept slightly forward and with winglets and root ribs; sweptback fin, plus underfin doubling as tailwheel mount. Chemical hopper between engine and cockpit, capacity 500 litres (132 US gallons; 110 Imp gallons). Service life 3,000 hours/10 years.

FLYING CONTROLS: Conventional and manual. Horn-balanced single-piece elevator and rudder; trim tab in elevator; trailing-edge flaps.

LANDING GEAR: Tailwheel type; fixed. Mainwheel size 8.00-6, tailwheel size 310x135. Hydraulic brakes.

POWER PLANT: One 184 kW (247 hp) LOM M337S six-cylinder engine operating on a 1:2 mix of A-76 and A-92 mogas; LOM B-546 three-blade ground-adjustable propeller. Plans for uprated, 186 kW (250 hp) version in production aircraft. Fuel tank in each wing; total capacity 210 litres (55.5 US gallons; 46.2 Imp gallons).

ACCOMMODATION: Pilot only on energy-absorbing seat; baggage shelf behind seat. Cockpit is pressurised to prevent ingress of chemicals, and incoming air is filtered.

EQUIPMENT: Transland underwing spraybar. Cable cutter/deflector standard.

DIMENSIONS, EXTERNAL:

Wing span	11.53 m (37 ft 10 in)
Length overall	8.10 m (26 ft 6 3/4 in)
Height overall	2.655 m (8 ft 8 1/2 in)

WEIGHTS AND LOADINGS:

Normal T-O and landing weight	1,200 kg (2,646 lb)
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PERFORMANCE (estimated):

Operating speed	81–97 kt (150–180 km/h; 93–112 mph)
Stalling speed	41 kt (76 km/h; 48 mph)
Typical operating altitude	1 to 15 m (3 to 50 ft)
Ferry range:	
with spraybars	486 n miles (900 km; 559 miles)
without spraybars	648 n miles (1,200 km; 745 miles)

SUKHOI Su-80

TYPE: Twin-turboprop transport.

PROGRAMME: First, largest and most advanced design by Sukhoi under *komversiya* programme of former Soviet industry; to replace L-410, An-28, Yak-40 and An-24; certification intended to FAR Pt 25, JAR 25 and AP-25. Work began 1989 on medical evacuation aircraft, then designated S-80, under order from Ministry of Public Health, by Sukhoi-Europe/Asia joint stock company, with founder members Sukhoi Design Bureau ASIC, KnAAPO (which see), Rybinsk Motor Engineering Design Bureau, Ramenskoye Instrument Engineering Design Bureau, and Instrument Engineering R&D Institute. Included in government's civil aviation plan, but minimal funding by public money. Model displayed 1989 Paris Air Show; funding ended with collapse of USSR; project revived 1992, with priority on more marketable passenger and passenger/cargo variants, with imported engines, propellers and avionics.

Manufacture of flying prototype and test airframe under way at KnAAPO's Komsomolsk-on-Amur plant by 1993; Rybinsk TVD-500 turboprop engines originally intended; agreement with General Electric to fit CT7-9 turboprops early 1995; design further refined and military versions reintroduced 1996; first flight scheduled second half 1996 but repeatedly postponed; prototype (RA-82911, in Su-80GP configuration) shown on production line on 15 May 1998 to representatives of Border Guards, MoD, and Magadan, Khabarovsk and Petropavlovsk-Kamchatski airlines; was handed over to Sukhoi for flight test preparation in January 2000 and relocated to Zhukovskiy; first flight 4 September 2001; had flown 40 sorties by May 2002.

One static test airframe delivered to SIBNIA at Novosibirsk in early 1998. First four pre-series aircraft manufactured at KnAAPO; initially Nos. 02 and 04 assigned to static testing, but by 2006 this changed to one static and three flying, all four to be of stretched version with additional 1.40 m (4 ft 7 in) fuselage length, increasing passenger capacity from 26 to 30. Work suspended for several years, although resumed in 2005. Initial pre-production aircraft first flew, unregistered, at Komsomolsk on 29 June 2006.

Further batch of eight aircraft under assembly at KnAAPO by mid-2006. Dal'Avia at Khabarovsk expected to be first recipient (three aircraft) in 2009, suggesting further delay of planned March 2008 AP-23/FAR Pt 23 certification.

Nothing further reported of 2003 discussions for possible licensed production in China, South Korea and the United Arab Emirates.

CURRENT VERSIONS: **Su-80GP**: Basic cargo/passenger (*gruzov/passazhirski*) version.

Detailed description applies specifically to Su-80GP; generally to all versions.

Su-80M: Medical evacuation (10 casualties) version.

Su-80P: Passenger (*passazhirski*) version.

Su-80PT: Patrol transport, embodying Leninets Strizh (martin) avionics suite, with undernose 360° search radar and rotating electro-optic (FLIR/LILT/TV) sensor turret under centre-fuselage; one operator's console in cabin. Able to perform 6 to 9 hour patrol missions over sea and land frontiers up to 189 n miles (350 km; 217 miles) from base; personnel and cargo transportation; and airdropping up to 20 paratroops and/or cargo. Flight crew of two or three.



Maiden flight of first pre-production Sukhoi Su-80GP at Komsomolsk on 29 June 2006

1162402



First take-off of pre-production Su-80GP

1162403

Su-80TD: Troop, paratroop (total 21), freight and medevac transport, generally similar to civil S-80GP, but with mechanised cargo-handling equipment.

CUSTOMERS: Market for 160 to 200 domestic sales estimated in 2001. Interest from 15 domestic customers in late 2002; export prospects include Argentina, China, Czech Republic, Indonesia, Malaysia, Thailand and Vietnam. Proposed for Russian Air Forces' future tactical military transport aircraft requirement and for Malaysian maritime patrol aircraft requirement. Total of 64 orders held by late 2002.

COSTS: Notionally funded by Russian Federation government but, by early 1997, KnAAPO had invested over RUR20 billion in development, compared with RUR1.5 billion received from official sources. KnAAPO investment raised to RUR1.7 billion by 2006. Of USD20 million expended by mid-2000, two-thirds provided by KnAAPO; thereafter, Sukhoi providing funds for flight test programme, estimated as further USD20 million. Flyaway price RUR230 to RUR280 million (2006 estimate).

DESIGN FEATURES: Utility freighter with unobstructed rear access for loading and wide track landing gear. Basically conventional high-wing, podded fuselage, twin-boom, rear-loading configuration, but with short tandem-wing surfaces between each tailboom and rear fuselage; unswept wings of high-aspect ratio with no dihedral or anhedral; large-span constant chord inner panels; small sweptback winglets on tapered outer panels; sweptback vertical tail surfaces, toed slightly inward, with bridging horizontal surfaces. Systems, accessories and components of Su-25, Su-27 and Su-35 embodied in Su-80. Automatic built-in systems testing.

FLYING CONTROLS: Conventional and manual. Actuation by rods and cables; flaps in three sections per wing with one section inboard of boom; split ailerons with two trim tabs on port side and one on starboard, electrically actuated; electrically actuated trim tab in each rudder.

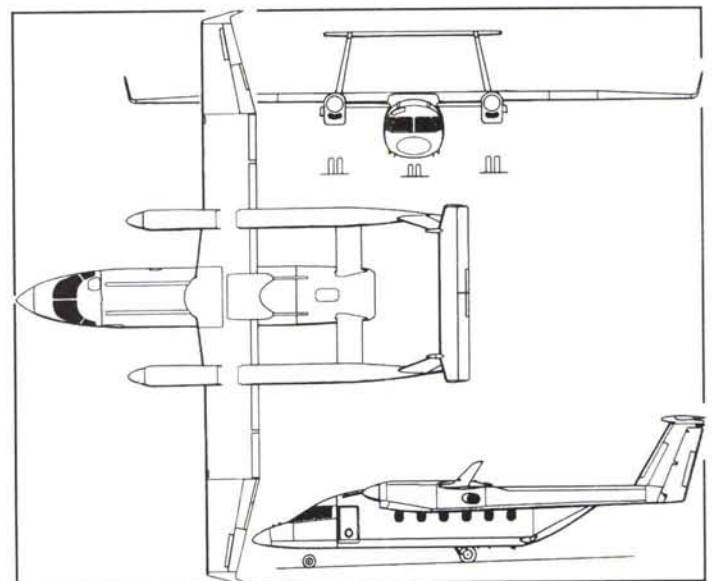
STRUCTURE: Materials used in construction comprise 70 per cent aluminium alloy, 8 per cent composites, 6 per cent steel, 6 per cent titanium, 2.5 per cent stainless steel, 7 per cent other non-metals and 0.5 per cent other metals.

Fuselage reinforcement band in line with propellers.

LANDING GEAR: Retractable tricycle type; main units retract rearwards and are enclosed by four sequenced doors per side; nose unit retracts rearwards with two sequenced doors; twin wheels on each unit; main units retract into tailbooms; mainwheel tyre size 660x200-356; nosewheel tyres 500x170-254; nosewheels steerable $\pm 38^\circ$.

POWER PLANT: Two 1,305 kW (1,750 shp) General Electric CT7-9B turboprops; production aircraft with engines built locally by GE-Saturn Aero Engines; Hamilton Sundstrand 14RF-35 feathering and reversible-pitch four-blade propellers. Provision for engine to function as APU with propeller stationary. Two fuel tanks, total capacity 3,656 litres (966 US gallons; 804 Imp gallons).

ACCOMMODATION: Two pilots and 30 passengers in four-abreast seating at 76 cm (30 in), or 3,300 kg (7,275 lb) of freight or mission equipment. All accommodation pressurised and air-conditioned. Baggage space, lavatory, wardrobe or galley at front, as specified by



Production version of Sukhoi Su-80

1162418

customer. Rear ramp space utilised for luggage racks. Available in 'Salon' configuration with nine, 12 or 16 passenger seats. Typical freighter has a row of seats behind flight deck and unobstructed main hold for a small vehicle or cargo. Door at centre of cabin on port side; hydraulically actuated; rear-loading ramp; emergency door on starboard side, opposite main door.

SYSTEMS: Electrical system developed by Lucas Aerospace and Auxilec. Anti-icing system by Goodrich. APU for autonomous operation at remote, unprepared sites, AVIONICS: Integration by Elektroavtomatika.

Comms: Com/nav, identification and ATC equipment, VOR/DME/ILS for ICAO Cat. II operation of Russian manufacture.

Flight: Elektroavtomatika PNK-80 navigation system. AFCS and autopilot and satellite nav system of Russian manufacture.

Instrumentation: Russian-manufactured five-screen EFIS proposed for production aircraft. EQUIPMENT: Options include equipment for air photography.

ARMAMENT: (Su-80PT) Typically 23 mm GSh-23L gun pod pylon-mounted on starboard side of cabin; four underwing pylons for electro-optical ASM, 20-round rocket pack, cluster of eight Vkhtr tube-launched missiles and R-60 (AA-8 'Aphid') self-defence AAM.

DIMENSIONS, EXTERNAL:

Wing span	23.17 m (76 ft 0¼ in)
Wing chord: at root	2.16 m (7 ft 1 in)
at tip	1.20 m (3 ft 11¼ in)
Wing aspect ratio	12.2
Length overall	18.26 m (59 ft 10¾ in)
Height overall	5.52 m (18 ft 1¼ in)
Tailplane span	7.00 m (22 ft 11½ in)
Wheel track	6.30 m (20 ft 8 in)
Wheelbase	6.34 m (20 ft 9½ in)
Propeller diameter	3.35 m (11 ft 0 in)
Propeller ground clearance	1.10 m (3 ft 7¼ in)
Distance between propeller centres	6.30 m (20 ft 8 in)
Passenger door/rear loading ramp:	
Height	1.82 m (5 ft 11¼ in)
Width	1.89 m (6 ft 2½ in)
Crew door/Type II emergency exit:	
Height	1.275 m (4 ft 2¼ in)
Width	0.76 m (2 ft 6 in)
Type II emergency exits (each):	
Height	1.315 m (4 ft 3¾ in)
Width	0.51 m (1 ft 8 in)
Type III emergency exits (each):	
Height	0.915 m (3 ft 0 in)
Width	0.51 m (1 ft 8 in)

DIMENSIONS, INTERNAL:

Cabin: Length, excl ramp	7.75 m (25 ft 5 in)
Max width	2.17 m (7 ft 1½ in)
Max height	1.82 m (5 ft 11¼ in)
Volume, incl ramp	approx 30.65 m ³ (1,082 cu ft)

AREAS:

Wings, gross	44.36 m ² (477.5 sq ft)
Ailerons (total)	3.72 m ² (40.04 sq ft)
Trailing-edge flaps (total)	7.10 m ² (76.42 sq ft)
Fins (total)	5.75 m ² (61.89 sq ft)
Rudders (total)	2.55 m ² (27.45 sq ft)
Horizontal tail surfaces	8.17 m ² (87.94 sq ft)
Elevators (total)	3.22 m ² (34.66 sq ft)

WEIGHTS AND LOADINGS (A: Su-80GP passenger; B: Su-80GP cargo):

Max payload: A	2,730 kg (6,019 lb)
B	3,300 kg (7,275 lb)
Max fuel: A, B	2,870 kg (6,327 lb)
Payload with max fuel: A	1,280 kg (2,822 lb)
B	1,630 kg (3,594 lb)
Max T-O weight: A, B	14,200 kg (31,306 lb)
Max ramp weight: A, B	14,350 kg (31,636 lb)
Max wing loading: A, B	326.8 kg/m ² (66.95 lb/sq ft)
Max power loading: A, B	5.56 kg/kW (9.13 lb/shp)

PERFORMANCE (estimated):

Max cruising speed	254 kt (470 km/h; 292 mph)
Normal cruising speed	232 kt (430 km/h; 267 mph)
Econ cruising speed	227 kt (420 km/h; 261 mph)
Max certified altitude	6,000 m (19,685 ft)
Service ceiling	7,600 m (24,934 ft)
T-O run	840 m (2,756 ft)
T-O balanced field length	1,300 m (4,265 ft)
Landing run with propeller reversal	460 m (1,509 ft)
Range: with max payload:	
A	755 n miles (1,400 km; 869 miles)
B	567 n miles (1,050 km; 652 miles)
Range with max fuel: A, B	1,322 n miles (2,450 km; 1,522 miles)
Ferry range: A, B	1,457 n miles (2,700 km; 1,677 miles)

OPERATIONAL NOISE LEVELS: Designed to conform to FAR Pt 36 standards



Model of Sukhoi RRJ-95 (Paul Jackson)

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2003 KnaAPO at Komsomolsk-on-Amur was nominated to build RRJ-95 version as second production centre, with alternative site under consideration in late 2005. Target combined initial output of 60 aircraft per year. Development will focus initially on this version following poor market response to proposed RRJ-60 and RRJ-95 versions. RRJ-75 and -95 to be certified simultaneously, with-60 to follow. RRJ Airline Council established November 2003 with Western members to advise on specification. A stretched 100-110-seat version was under study in early 2006.

CURRENT VERSIONS: **RRJ-60**: Formerly RRJ-55. Shrunk version; two fuselage sections, of 1.00 m (3 ft 3½ in) and 1.50 m (4 ft 11 in) respectively, removed fore and aft of wing.

RRJ-60LR: Long-range version.

RRJ-75B: Baseline version.

RRJ-75LR: Long-range version.

RRJ-95: Stretched version; two plugs, one of 1.50 m (4 ft 11 in) and one of 2.00 m (6 ft 6¾ in) respectively, inserted fore and aft of wing.

RRJ-95LR: Long-range version.

RBJ: Proposed business jet version, under study in early 2004.

CUSTOMERS: Launch customer Aeroflot ordered 30 RRJ-95s in two-class configuration for delivery between November 2008 and 2011, replacing Tuoplev TU-134S; Russian Finance Leasing Corporation has ordered 10; Concord Aviation of Dubai has signed a letter of intent for 20 RRJ-95s, plus 20 options, for lease to airline operators; Siberia Airlines has indicated a requirement for up to 50 RRJs; GTK Rossiya, which provides air transport for the President of Russia, has a requirement for four RRJs. Production expected to total 600 by 2020, and final total of 800, of which some 40 per cent are expected to be ordered by CIS airlines, the remainder for export customers.

COSTS: Development costs estimated at USD913 million, plus USD684 million for engine (both 2005). Unit cost estimated at USD27 million (2006).

DESIGN FEATURES: Low-mounted, sweptback wings with podded engine on each. Sweptback horizontal and vertical tail surfaces. Airframe design optimised on RRJ-75 with goal of maximum commonality across the range of models.

FLYING CONTROLS: Fly-by-wire, with sidestick controllers.

STRUCTURE: Primarily aluminium alloy. Announced suppliers/supply partnerships include: B/E Aerospace (cabin interior and oxygen system); Air Cruiser (emergency rescue equipment); Curtiss-Wright Autronics (fire protection system); Dassault Systèmes/IBM (product lifecycle management); Goodrich (wheels and brakes); Hamilton Sundstrand (electrical system); Honeywell/MMPP Salyut (APU); Intertechnique/OAO Apris (fuel system); IPECO (pilots' seats); Messier Dowty/OAO Gidromash (landing gear); Liebherr/OAO Ehlektropribor (FBW control system); Liebherr/OAO Teploobmennik (air-conditioning, pressurisation control and anti-icing systems); Messier-Dowty (landing gear); Parker Aerospace (hydraulic system); Sully (windows); Thales/OAO Aviaprobhorholding (avionics and cockpit displays) and Vibro-Meter SA (engine vibration system).

LANDING GEAR: Retractable tricycle type. Twin wheels on each unit, with option of four-wheel high flotation bogey on main units.

POWER PLANT: Two Snecma/NPO Saturn Power Jet SM146 turbofans, with FADEC, pod-mounted beneath wings, each rated at 60.0 kN (13,500 lb st) to 68.5 kN (15,400 lb st), according to version; 68.5 kN (15,400 lb st) to 77.8 kN (17,500 lb st) with automatic power reserve. Fuel capacity 13,135 litres (3,470 US gallons; 2,889 Imp gallons).

ACCOMMODATION: Overhead baggage bins allow 0.08 m³ (2.74 cu ft) per passenger.

Underfloor baggage compartments beneath front and rear of cabin.

RRJ-60: Seats 60 passengers at 81 cm (32 in) seat pitch, or 68 passengers at 76 cm (30 in), all in single class accommodation in 3 + 2 abreast configuration, with two lavatories.

RRJ-75: Seats 75 passengers at 81 cm (32 in) seat pitch, or 83 passengers at 76 cm (30 in), all in single class accommodation with two lavatories and full-size or small forward galley, respectively; or 10 first class passengers at 89 cm (35 in) seat pitch and 58 tourist class passengers at 76 cm (30 in) in two-class configuration, with three lavatories and full-size forward galley.

RRJ-95: Seats 95 passengers at 81 cm (32 in) seat pitch, or 105 passengers at 76 cm (30 in), all in single class accommodation with two lavatories and full-size or small forward galley respectively; or eight first class passengers at 91 cm (36 in) seat pitch and 78 tourist class passengers at 84 cm (33 in) in two-class configuration, with three lavatories and full-size forward galley.

AVIONICS: Thales 'Top Deck' five-tube EFIS cockpit based on that of Airbus A380.

Cat. IIIa landing capability.

All data are provisional.

DIMENSIONS, EXTERNAL:

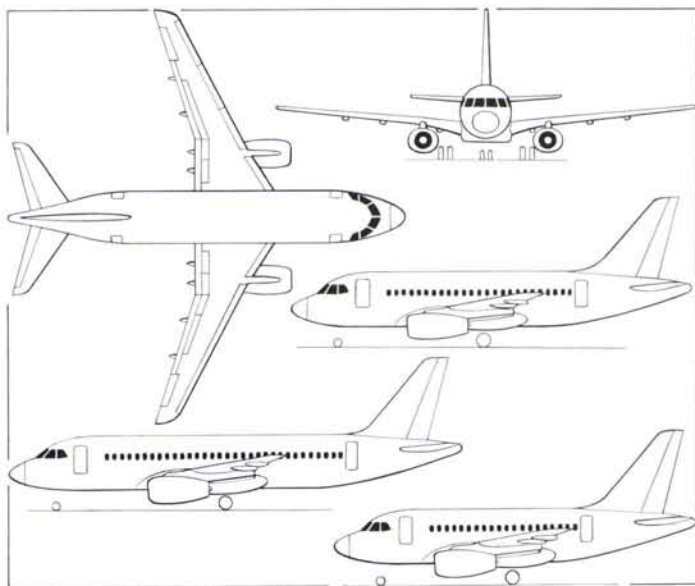
Wing span	27.80 m (90 ft 2¾ in)
Wing aspect ratio	9.8
Length overall: RRJ-60	23.87 m (80 ft 4½ in)
RRJ-75	26.33 m (86 ft 4½ in)
RRJ-95	29.83 m (97 ft 10½ in)
Fuselage: Max width	3.46 m (11 ft 4¼ in)
Max depth	3.62 m (11 ft 10½ in)
Height overall	10.28 m (32 ft 10½ in)
Tailplane span	10.03 m (32 ft 10¾ in)
Wheel track	5.74 m (18 ft 10 in)
Wheelbase: RRJ-60	8.40 m (27 ft 6¾ in)
RRJ-75	9.26 m (30 ft 4½ in)
RRJ-95	11.26 m (36 ft 11¼ in)
Main passenger door (port, fwd):	
Height	1.83 m (6 ft 0 in)
Width	0.86 m (2 ft 9¾ in)
Passenger door (port, rear): Height	1.83 m (6 ft 0 in)
Width	0.76 m (2 ft 6 in)
Service doors (stbd, fwd and rear): Height	1.65 m (5 ft 5 in)
Width	0.76 m (2 ft 6 in)

SUKHOI SUPERJET 100

TYPE: Regional jet airliner.

PROGRAMME: On 13 April 2001, Rosaviakosmos and The Boeing Company agreed to joint development and marketing of the Russian Regional Jet (RRJ; transliterated into Cyrillic as RRZh, but also known by Sukhoi as *grazhdanskije samolet*: Civil Aircraft). At the Paris Air Show on 21 June 2001 it was announced that AVPK Sukhoi (Sukhoi Civil Aircraft) will lead the design and manufacture of the aircraft, with Ilyushin holding responsibility for certification, and Boeing handling marketing, sales, leasing and after-sales support. Three firms signed agreement 20 July 2001.

Provisional configuration and specification announced 13 August 2001, on eve of Moscow Salon. Initial phase of feasibility studies between June and December 2001; second phase completed in July 2002. Announced as winner of Russian Aviation & Space Agency (*Rosaviakosmos*) tender on behalf of Russian government for 200 regional jets on 12 March 2003; agreement on long-term co-operation between Sukhoi and Boeing signed next day. System suppliers conference 21–23 January 2004. Preliminary design review conducted with Boeing participation between 23 and 30 April 2004; first flight of first of six planned prototypes expected in 2007, with Russian AP-25 and FAR/JAR-25 certification and service entry in October 2008. Irkut originally intended as sole production centre, but in February



Sukhoi RRJ-75, with additional side views of RRJ-95 (centre) and RRJ-60 (bottom) (James Goulding)

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Baggage doors: Height	0.89 m (2 ft 11 in)
Width	1.22 m (4 ft 0 in)
DIMENSIONS, INTERNAL:	
Cabin:	
Length: RRJ-60	14.65 m (48 ft 0 3/4 in)
RRJ-75	17.15 m (56 ft 3 3/4 in)
RRJ-95	20.65 m (67 ft 9 in)
Width: max	3.26 m (10 ft 8 3/4 in)
at floor	3.00 m (9 ft 10 in)
Max height	2.12 m (6 ft 11 1/2 in)
Overhead bins (per passenger)	0.06 m ³ (2.12 cu ft)
Baggage hold:	
forward:	
Length: RRJ-60	2.475 m (8 ft 1 1/2 in)
RRJ-75	3.475 m (11 ft 4 3/4 in)
RRJ-95	4.975 m (16 ft 3 3/4 in)
Height: all	1.015 m (3 ft 4 in)
Volume: RRJ-60	4.97 m ³ (175.5 cu ft)
RRJ-75	6.97 m ³ (246.0 cu ft)
RRJ-95	9.99 m ³ (352.8 cu ft)
aft:	
Length: RRJ-60	3.47 m (11 ft 4 1/2 in)
RRJ-75	4.97 m (16 ft 3 3/4 in)
RRJ-95	6.97 m (22 ft 10 1/2 in)
Height: all	1.015 m (3 ft 4 in)
Volume: RRJ-60	6.11 m ³ (215.8 cu ft)

RRJ-75	9.13 m ³ (322.4 cu ft)
RRJ-95	13.15 m ³ (464.4 cu ft)

AREAS:

Wings, gross	77.00 m ² (828.8 sq ft)
Flaps (total)	13.90 m ² (149.62 sq ft)
Fin	15.40 m ² (165.76 sq ft)
Tailplane	19.60 m ² (210.97 sq ft)

WEIGHTS AND LOADINGS:

Max fuel weight:	
RRJ-60, RRJ-75, RRJ-95	9,550 kg (21,054 lb)
RRJ-60LR, RRJ-75LR, RRJ-95LR	12,690 kg (27,977 lb)
Max payload:	
RRJ-60, RRJ-60LR	7,350 kg (16,204 lb)
RRJ-75, RRJ-75LR	9,440 kg (20,812 lb)
RRJ-95, RRJ-95LR	12,250 kg (27,007 lb)
Max T-O weight: RRJ-60	35,790 kg (78,903 lb)
RRJ-60LR	38,950 kg (85,870 lb)
RRJ-75	38,820 kg (85,583 lb)
RRJ-75LR	42,280 kg (93,211 lb)
RRJ-95	42,520 kg (93,740 lb)
RRJ-95LR	45,880 kg (101,148 lb)
Max landing weight: RRJ-60, RRJ-60LR	32,000 kg (70,548 lb)
RRJ-75, RRJ-75LR	35,000 kg (77,162 lb)
RRJ-95, RRJ-95LR	39,400 kg (86,862 lb)
Max wing loading: RRJ-60	464.8 kg/m ² (95.20 lb/sq ft)
RRJ-60LR	505.8 kg/m ² (103.60 lb/sq ft)
RRJ-75	504.2 kg/m ² (103.26 lb/sq ft)
RRJ-75LR	549.1 kg/m ² (112.46 lb/sq ft)
RRJ-95	552.2 kg/m ² (113.10 lb/sq ft)
RRJ-95LR	595.8 kg/m ² (122.04 lb/sq ft)

PERFORMANCE:

Cruising speed: max	M0.81
normal	M0.78
Approach speed at max landing weight:	
RRJ-60, RRJ-60LR	120 kt (222 km/h; 139 mph)
RRJ-75, RRJ-75LR	127 kt (235 km/h; 146 mph)
RRJ-95, RRJ-95LR	135 kt (250 km/h; 155 mph)
Initial cruise altitude	10,670 m (35,000 ft)
Max certified altitude	12,497 m (41,000 ft)
T-O field length: RRJ-60	1,277 m (4,190 ft)
RRJ-60LR	1,518 m (4,980 ft)
RRJ-75	1,585 m (5,200 ft)
RRJ-75LR	1,600 m (5,249 ft)
RRJ-95	1,620 m (5,315 ft)
RRJ-95LR	1,910 m (6,266 ft)
Landing field length:	
RRJ-60, RRJ-60LR	1,264 m (4,147 ft)
RRJ-75, RRJ-75LR	1,352 m (4,436 ft)
RRJ-95, RRJ-95LR	1,493 m (4,898 ft)
Range with max payload:	
RRJ-60	1,730 n miles (3,204 km; 1,990 miles)
RRJ-60LR	2,629 n miles (4,870 km; 3,026 miles)
RRJ-75	1,727 n miles (3,200 km; 1,988 miles)
RRJ-75LR	2,629 n miles (4,870 km; 3,026 miles)
RRJ-95	1,684 n miles (3,120 km; 1,938 miles)
RRJ-95LR	2,478 n miles (4,590 km; 2,852 miles)

TUPOLEV

**TUPOLEV OAO
(TUPOLEV JSC)
AVIATSIONNY NAUCHNO-TEKHNICHESKY KOMPLEKS IMENI A
N TUPOLEVA OAO
(AVIATION SCIENTIFIC-TECHNICAL COMPLEX NAMED FOR A N
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Under decree of 30 June 1999, Tupolev PSC (Public Stock Company) formed 30 July 1999, combining Tupolev design bureau and Aviatstar production plant at Ulyanovsk, with financial interest from Russian government amounting to 51 per cent, plus 43.6 per cent from Aviatstar. PSC also holds intellectual rights to Tupolev designs previously owned by government. New entity was recertified by Interstate Aviation Committee Aviation Registrar in December 2000. Kazan plant will be incorporated later.

Other activities include sales and leasing of jet transports, aircraft operation and after-sales support. Tupolev Aviation Leasing Company supplies Tu-204, Antonov An-124 and Yakovlev Yak-40 transports.

Tupolev Bureau was founded by Andrey N Tupolev (1888–1972) on 22 October 1922 and concentrated primarily on large military and civil aircraft until the early 1990s; Andrey A Tupolev (1925–2000) succeeded his father as General Designer; since 1922, Bureau has designed 300 aircraft, of which nearly 90 were built as prototypes and 35 placed in production; current effort is 80 per cent civil programmes.

It was suggested in 1998 that Tupolev had begun preliminary design of a new bomber to replace the Tu-160 and, probably, Tu-95/142; this would enter service some time after 2010 and may be based on earlier studies, such as the Tu-202 bomber of the 1980s or the more recent Tu-404 700/850-seat airliner. Continued work was confirmed in late 2002, although as a private study and "based on a new concept", which "is at the very earliest stage". By

December 2004, C-in-C of Russian Strategic Air Force was hinting that 'fifth generation' bomber would be based on Tu-160, noting that, "It is not necessary to create a principally new aeroplane, since the Tu-160 has achieved only 60 per cent of its capabilities".

In addition, Bureau remains heavily committed to the development of a civil supersonic transport aircraft and of cryogenic fuels for jet and turboprop transports.

Tupolev's head office, main design bureau and experimental facility are in Moscow; Tomilino branch and flight research centre at Zhukovsky; and design offices at Samara, Kazan and Voronezh.

TUPOLEV Tu-160

NATO reporting name: Blackjack

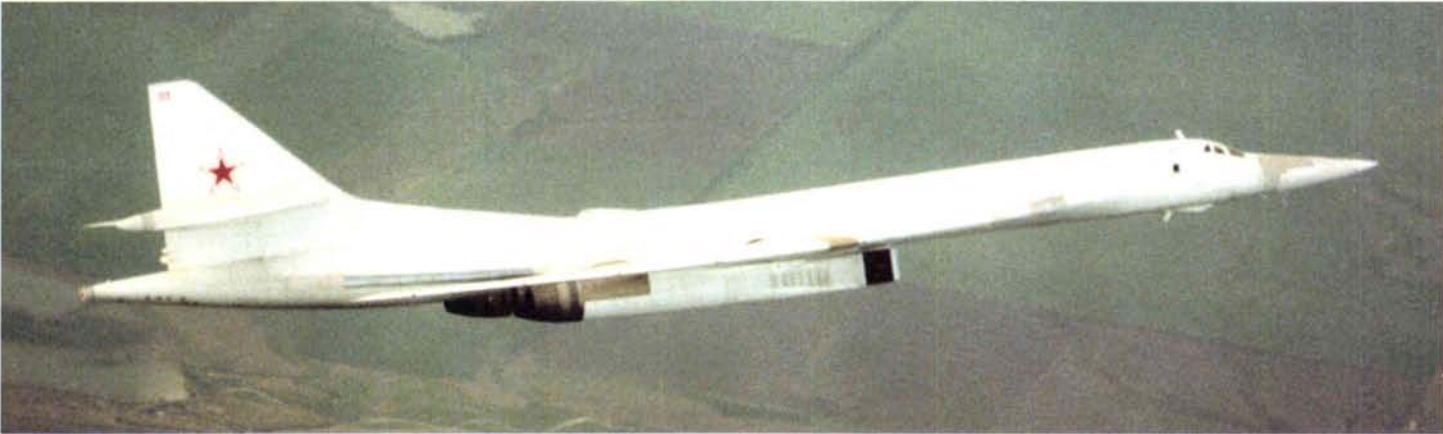
Unofficial name: Belyi Lebed (White Swan)

TYPE: Strategic bomber.

PROGRAMME: Designed as Article 70 (or Aircraft K) under leadership of Valentin I Bliznuk; programme began 1967, but relaunched following issue of more modest specification in 1970; competitors were Myasishchev M-18 and Sukhoi T-4MS; derived from unbuilt Tu-135 bomber and Tu-144 derivatives; won design competition in 1972; incorporated some features from M-18. First of two prototypes (70-01) observed by intelligence source at Zhukovsky flight test centre 25 November 1981 (photographed from landing airliner); first flew 18 or 19 December 1981; first exceeded M1.0 February 1985; second (production-standard) aircraft first flew 7 October 1984. Third prototype (70-03) set world records for altitude, speed in a closed circuit and weight-to-altitude on 31 October 1989. Further nine closed-circuit records established 22 May 1990 by aircraft '70-304'; total 57 records including 44 world records, held by Tu-160s at various times.

Second production aircraft lost in pre-delivery take-off crash, March 1987; US Defense Secretary Frank Carlucci invited to inspect 12th aircraft built, at Kubinka air base, near Moscow, 2 August 1988; deliveries to 184th Guards Heavy Bomber Aviation Regiment, Priluki airbase, Ukraine, began April 1987; equipment of 1096th HBAR at Engels from 16 February 1992, but only six received before production at Kazan airframe plant terminated 1992; of 100 aircraft due to be built, at least 32 (including prototypes) accounted for by mid-1990s while Tupolev confirmed in 2004 production of 33, of which 20 remaining. Figures apparently do not reflect three uncompleted airframes gradually being assembled at Kazan.

In 2001, Russia was reported to be formulating a Tu-160 upgrade, to be undertaken at Kazan, which includes provision for a conventionally armed cruise missile. Upgrade of 15 aircraft was agreed late 2001 and formally announced at Kazan on 18 January 2002; work will extend service lives to 2030; first upgrade candidate was delivered to Kazan on 5 April 2002. In October 2002, Tupolev confirmed this to be a two-stage upgrade, the first part



Tupolev Tu-160 'Blackjack' (Yefim Gordon)

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(2003–04) concentrating on the addition of new weapons and the second, at an unspecified date, involving new avionics for navigation, attack and electronic warfare, with high degree of commonality with parallel Tu-22M and Tu-142 (Tu-95MS) upgrades.

One Tu-160 prototype will participate in development of a 'significantly different', fifth-generation bomber, according to December 2004 statement by Strategic Air Force commander, who also revealed that existing Tu-160s were then only half-way through service lives.

CURRENT VERSIONS: **Tu-160: ('Blackjack')** Strategic bomber.

Tu-160SK: Commercialised, demilitarised version, as carrier component of Burlak aviation space launch system; Burlak-Diana two-stage rocket, carrying payload, under fuselage on centreline mount. Announced at Singapore Air Show '94; proposed by Russian partners MKB-Raduga, OKB MEI and Tupolev, with German company OHB-System. At the 1995 Paris Air Show, Tu-160 0401 was exhibited statically (the type's Western debut) with a model Burlak rocket below the fuselage. Development of the system continued even after the German government withdrew funding in 1998, and may form the basis of the Ukrainian/PIC HAAL-2000 programme.

Tu-160M: Proposed stretched variant carrying two 2,700 n mile (5,000 km; 3,107 mile) range hypersonic Kh-90 missiles.

Tu-160P: Proposed very long-range escort fighter.

Tu-160PP: Proposed escort jammer.

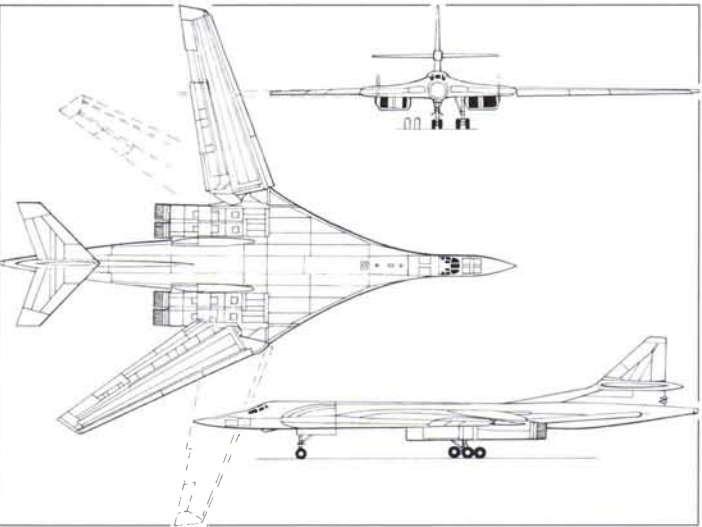
Tu-160R: Proposed strategic reconnaissance platform.

CUSTOMERS: Manufacture totalled 33 up to 2000; believed to comprise three prototypes (70-01, 70-02 and 70-03) and 30 production aircraft (0101 to 0110, 0201 to 0210 and 0401 to 0410). In January 2001, Russia had seven operational Tu-160s; a further eight undergoing refurbishment for delivery over following months; and one actively under construction. Five more prototype and trials aircraft unserviceable at Zhukovsky during late 1990s ('18', '29', '30', '86' and '87'), plus sixth resident (0401 '63') as airworthy testbed. On 22 December 2005, 0401 was named *Boris Ivanovich Veremey*, still at Zhukovsky; at that time, total of 14 other Tu-160s in Air Forces service.

Of original deliveries, Ukraine government seized 19 at Priluki on achieving independence, pre-empting planned transfer to Engels; purchase of these by Russia was subject to protracted negotiations, and aircraft deteriorated in storage; March 1996 agreement on transfer of 10 best airframes was not implemented; attempts to purchase eight failed in March 1998 and Russia then supposedly abandoned hopes of expanding Tu-160 fleet. However, October 1999 announcement revealed eight to be returned to Russia for refurbishment (together with three Tu-95MSs, for a total of US\$285 million) and these were delivered between 5 November 1999 and 21 February 2000. Six others scrapped with US assistance, last being destroyed on 4 February 2001. August 2000 report mentioned further three Tu-160s which Ukraine could return to Russia in part-payment for natural gas deliveries; these later destroyed. Eleventh and final remaining Ukrainian Tu-160 was flown to Poltava Kondratyuk-Shagray aerospace museum on 5 April 2000.

Russia maintained force of six (declared as ALCM carriers under START) at Engels (where 1096th HBAR was redesignated as part of the 121st Guards HBAR, within 22 Air Division, in 1994), plus flying testbed at Zhukovsky; at least four more were derelict at Zhukovsky by 1995. Eight more had been due to re-enter service from 2001 after purchase from Ukraine, while plan announced in June 1999 to complete one unfinished Tu-160 at Kazan. This aircraft ('07' *Aleksandr Molodchyi*) was delivered on 5 May 2000.

Another, brand new Tu-160 (the first of three more incomplete, unfinished aircraft at Kazan), due to be delivered in late 2002; this was rescheduled for 2005, together with redelivery of a refurbished aircraft; formal acceptance on 30 December 2005, and actual



Tupolev Tu-160 strategic bomber (James Goulding)

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delivery to Air Forces (as 15th operational Tu-160) took place on 5 July 2006; remaining two new aircraft will follow, increasing the fleet to 18 by 2008. At one time there were plans to refurbish some (perhaps four) of the grounded aircraft at Zhukovsky. Ex-Ukrainian aircraft failed to enter service when planned due to poor condition and need for extensive refurbishment; requirements were still being discussed in early 2002. Plans not adopted for Tu-160 to re-enter limited production, to meet a stated requirement for 25 operational 'Blackjacks' by 2003, allowing formation of a second regiment.

Original six at Engels are also named: '01' *Mikhail Gromov* (crashed 18 September 2003; second Tu-160 loss); '02' *Vasily Retsemnikov*; '03' *Pavel Taran*; '04' *Ivan Yargin*; '05' *Il'ya Muromets* (1) and '06' *Il'ya Muromets* (2). Others subsequently named: 10th (fleet number '16') *Aleksey Plokhov* on 17 April 2003; '15' became *Vladimir Sudets* on 6 December 2004; and '18' *Valentin Ivanovich Bliznyuk* (current head of Tu-160 design at Tupolev) on delivery, 5 July 2006. Another is to be named *Valery Chkalov*.

On 3 March 1999, the Russian Commonwealth Aerospace Technology Consortium (RCATC) was authorised by the Ukrainian government to sell three demilitarised Ukrainian Air Force Tu-160s, plus spares, to Platforms International Corporation of the USA, with which it has finalised a strategic partnership. The US\$20 million deal includes a 20 per cent interest in Orbital Network Services Corporation, which plans to use the aircraft as reusable communications satellite launchers in its HAAL-2000 high-altitude Air Launch programme. The aircraft would probably be modified to Tu-160sK standards and continue to be based at Priluki, maintained and flown by Ukrainian crews, but flown to customer countries for individual space launch missions.

TUPOLEV Tu-160 DISPOSITION
(at August 2006)

Russian Federation; original deliveries	7
Russian Federation; ex-Ukraine	8
Ukraine; Scrapped	10
Ukraine; museum	1
USSR; crashed pre-delivery	1
Russian Federation; crashed 2003	1
Prototypes	3
Flyable testbed	1
Unairworthy former testbeds	2
Subtotal	34
Under construction	2
Total	36

DESIGN FEATURES: Intended for high-altitude standoff role carrying ALCMs and for defence suppression, using short-range attack missiles similar to US Air Force SRAMs, along path of bomber making low-altitude penetration to attack primary targets with free-fall nuclear bombs or missiles; this implies capability of subsonic cruise/supersonic dash at almost M2 at 18,300 m (60,000 ft) and transonic flight at low altitude. About 20 per cent longer than USAF B-1B, with greater unrefuelled combat radius and much higher maximum speed; low-mounted variable geometry wings, with very long and sharply swept fixed root panel; small diameter circular fuselage; horizontal tail surfaces mounted high on fin, upper portion of which is pivoted one-piece all-moving surface; large dorsal fin; engines mounted as widely separated pairs in underwing ducts, each with central horizontal V wedge intakes and jetpipes extending well beyond wing centre-section trailing-edge; manually selected outer wing sweepback 20, 35 and 65°; when wings fully swept, inboard portion of each trailing-edge flap hinges upward and extends above wing as large fence; unswept tailfin; sweptback horizontal surfaces, with conical fairing for brake-chute aft of intersection.

FLYING CONTROLS: Quadruplex fly-by-wire with mechanical reversion. Full-span leading-edge flaps, long-span double-slotted trailing-edge flap and inset drooping aileron on each wing; five-section spoilers forward of flaps; all-moving vertical and horizontal one-piece tail surfaces.

STRUCTURE: Slim and shallow fuselage blended with wing-roots and shaped for maximum hostile radar signal deflection; 20 per cent titanium, including leading-edges and wing centre-section spar box.

LANDING GEAR: Twin nosewheels retract rearward; main gear comprises two bogies, each with three pairs of wheels; retraction very like that on Tu-154 airliner; as each leg pivots rearward, bogie rotates through 90° around axis of centre pair of wheels, to lie parallel with retracted leg; gear retracts into thickest part of wing, between fuselage and inboard engine on each side; so track relatively small. Nosewheel tyres size 1080x400; mainwheel tyres size 1260x425.

POWER PLANT: Four purpose-designed Samara NK-321 turbofans, each 137.3 kN (30,865 lb st) dry, 245 kN (55,115 lb st) with afterburning. In-flight refuelling probe retracts into top of nose. Fuel in centre-section spar box and in outer wings.

ACCOMMODATION: Four crew members in pairs, on individual Zvezda K-36LM zero/zero ejection seats, in pressurised compartment; one window each side of flight deck can be moved inward and rearward for ventilation on ground; flying controls use fighter-type sticks rather than yokes or wheels; crew enter via extending ladder in nosewheel bay. Cooking facilities, folding bed and lavatory.

AVIONICS: Systems utilise around 100 digital processors and eight digital nav computers. Radar: Obzor (NATO 'Clam Pipe') nav/attack radar in slightly upturned dielectric nosecone with separate Sopka radar providing terrain-following capability.

Flight: K-042K astro-inertial nav with map display.

Instrumentation: Analogue instruments, No HUD or CRTs.

Mission: OPB-15 strike sight fairing with flat glazed front panel, under forward fuselage, for video camera to provide visual assistance for weapon aiming.

Self-defence: Baikal self-protection system, with integrated RHAWs, chaff/flare dispensers in tailcone and active jamming.

ARMAMENT: No guns. Internal stowage for free-fall bombs, mines, short-range attack missiles or ALCMs; two tandem 12.80 m (42 ft) long weapon bays: MKU-6-5U rotary launcher for six (or up to 12) Kh-55MS (AS-15 'Kent') or RKV-500B (AS-15B 'Kent-B') ALCMs or 12 to 24 Kh-15P (AS-16 'Kickback') SRAMs in each bay. Aircraft upgraded from 2002 onwards have ability to launch Kh-555 missiles; later plans envisage carriage of up to 12 non-nuclear Kh-101 ALCMs, when available.

DIMENSIONS, EXTERNAL:

Wing span: fully spread (20°)	55.70 m (182 ft 9 in)
35° sweep	50.70 m (166 ft 4 in)
fully swept (65°)	35.60 m (116 ft 9 3/4 in)
Wing aspect ratio: fully spread	8.6
Length overall	54.10 m (177 ft 6 in)
Height overall	13.10 m (43 ft 0 in)
Tailplane span	13.25 m (43 ft 5 3/4 in)
Wheel track	5.40 m (17 ft 8 1/2 in)
Wheelbase	17.88 m (58 ft 8 in)

DIMENSIONS, INTERNAL:

Weapons bay (each): Volume	43.0 m ³ (1,518 cu ft)
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AREAS:

Wings, gross: fully swept	360.00 m ² (3,875.0 sq ft)
fully spread	approx 400.00 m ² (4,305.6 sq ft)
moving areas, fully swept (total)	approx 180.00 m ² (1,937.5 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	110,000 kg (242,505 lb)
Weight empty, equipped	117,000 kg (257,940 lb)
Max fuel	171,000 kg (376,990 lb)
Max weapon load	40,000 kg (88,185 lb)
Normal T-O weight	267,600 kg (589,950 lb)
Max T-O weight	275,000 kg (606,260 lb)
Max landing weight	155,000 kg (341,710 lb)
Max power loading	280 kg/kN (2.75 lb/lb st)

PERFORMANCE:

Max level speed at 12,200 m (40,000 ft)	M2.05 (1,200 kt; 2,220 km/h; 1,380 mph)
Cruising speed at 13,700 m (45,000 ft)	M0.9 (518 kt; 960 km/h; 596 mph)
Max rate of climb at S/L	4,200 m (13,780 ft)/min
Service ceiling	15,000 m (49,200 ft)
T-O run at max AEW	2,200 m (7,220 ft)
Landing run at max landing weight	1,600 m (5,250 ft)
Radius of action at M1.5	1,080 n miles (2,000 km; 1,240 miles)
Max unrefuelled range	6,640 n miles (12,300 km; 7,640 miles)
g limit	+2

TUPOLEV Tu-204 and Tu-214

TYPE: Twin-jet airliner.

PROGRAMME:

DEVELOPMENT MILESTONES

Tu-204	
Design began	1983
Programme launched	1986
First flight	2 Jan 89
Production go-ahead	1990
Certification	12 Jan 95
First delivery (204C)	Apr 95
Entered service (Vnukovo Airlines)	23 Feb 96
Subsequent versions	
Tu-204-300	
First flight	17 Aug 03
Tu-214	
First flight	21 Mar 96
Public debut	Sep 96
Certification	29 Dec 00
Entered service (Dal'avia)	23 May 01
Tu-234	
First flight	8 Jul 00

Development, to replace Tu-154 and Il-62, announced 1983; preliminary details available 1985; programme finalised 1986; first prototype (SSSR-64001), with PS-90AT engines, flown 2 January 1989 by Tupolev chief test pilot A Talalakine; two more prototypes (RA-64003, first flight 17 August 1990, and 004) followed, plus two (002 and 005) for structural and fatigue testing. Second version, with RB211-535E4-B engines, flew 14 August 1992 (fourth flying prototype, RA-64006) and was demonstrated at Farnborough Air Show in following month.

Production of basic Tu-204 series by Aviastar at Ulyanovsk began 1990, Tu-214 by KAPO at Kazan in 1994; Russian certification of basic Tu-204 received 12 January 1995; used initially only for freight services. First revenue-earning passenger flight, Moscow to Mineralnye Vody, operated by Vnukovo Airlines 23 February 1996. Restrictions on PS-90-engined Tu-204s were eventually removed in mid-1998. Deliveries outside CIS began on 2 November 1998 with handover of -120 and -120C freighter to Air Cairo on seven-year lease.

As at mid-2006, the variants certified to AP-25 and JAR 25 standards and in production were stated to be the Tu-204-100, Tu-204-120, Tu-204-120CE, Tu-204-300 and Tu-214.

Avionics upgrade under discussion with NII in mid-2000; goal is six LCD, two-pilot flight deck; estimated cost USD5 million to USD8 million. First application on Tu-204-300.

CURRENT VERSIONS: **Tu-204:** Basic medium-haul airliner for up to 210 passengers or maximum payload of 21,000 kg (46,295 lb); Aviadvigatel PS-90A turbofans. Marketed 1989. RVSM approval granted 28 December 2000. Details in earlier editions.

Tu-204C: Cargo version (27 t capacity) of basic Tu-204. (Western marketing designation is Tu-204C, but correct Cyrillic designation, used in Russian literature, is **Tu-204S**.) Certification received in August 2003. Aviastar production.

Tu-204-100: Extended-range passenger version of basic Tu-204; additional fuel in wing centre-section; dimensions, payload and power plant unchanged. Marketed 1993. First flight 9 August 2001. Aviastar production.

Tu-204-100C: Freighter, as Tu-204-100. Payload increased at expense of reduced maximum range. Marketed 1994. Bulk freight volume 180.0 m³ (6,357 cu ft), not including fore and aft underfloor holds.

Tu-204-120: As Tu-204-100, but with Rolls-Royce RB211-535B75 turbofans; Russian avionics. Prototype (RA-64006) flew 14 August 1992. First production aircraft (RA-64027) flew 7 March 1997; gained limited Russian certification on 16 July 1997 and full certification 12 months later. First delivery (Air Cairo) November 1998. JAA certification effort began May 2001. First five Sirocco 120/120Cs have Russian avionics; later aircraft are Phase II with Honeywell items, including VIA 2000 suite. Aviastar production.

Tu-204-120C: As -100C freighter, but RB211 engines; two for Air Cairo (via Sirocco). First aircraft (RA-64028) flew 10 November 1997; domestic certification completed by August 1998. JAA (now EASA) certification effort began May 2001 and had completed initial testing by beginning of 2004; approval anticipated by end of that year. First delivery 2 November 1998. Aviastar production. High gross weight version (**Tu-204-120CE**, indicating English language cockpit), with 30,000 kg (66,139 lb) payload, certified under AP-25 2004 and to JAR 25 July 2006. Maiden flight (RA-64030) 14 May 2006 by first of five for China; first two due for delivery to Air China Cargo September and December 2006, to be followed in March, June and September 2007 by three for China Eastern Airlines.

Tu-204-200: Further increase in payload and T-O weight; small increase in fuel in wing centre-section and adjacent baggage hold; dimensions and power plant as Tu-204-100; strengthened landing gear; marketed 1994. First example of Series 200 was a Tu-214 freighter, first flown in March 1996; first true Tu-204-200 (RA-64036) was nearing completion at Ulyanovsk in late 1998; PS-90 engines. By mid-2000, **Tu-214** designation was also being used for this version.

Tu-204-300: Short-fuselage, extended-range version of Tu-204-100. Prototyped by KAPO (static test only) as Tu-234. First flight test aircraft (RA-64026, built by Aviastar at Ulyanovsk) rolled out as Tu-234, minus engines, in mid-1996; fitted with PS-90s in early 2000 and reportedly first flew 8 July 2000 (ahead of prototype), although this has not been confirmed. Option for 20 signed by Transaero at MAKs air show, August 2003. Aviastar first production example (PS-90P engines) in final assembly May 2003; maiden flight (RA-64026) 17 August 2003 and public debut at MAKs 2003 following day. Certification programme joined by RA-64038 (first flight 25 November 2004) and certificate received 14 May 2005; handed over to first customer (Vladivostok Avia, four ordered in August 2003) six days later. Third aircraft (RA-64039) maiden flight 4 August 2005.

Tu-204-500: Projected Aviastar version; PS-90A2 engines and fuselage stretch to 52.00 m (170 ft 7 3/4 in); possible wing redesign for higher cruising speeds; private venture outside government's aviation plan. Designation first reported in early 2000. Details reported in late 2004 included 'smaller' wing, 105 tonne MTOW and M0.84 max cruising speed. Development said to be continuing at that time, but no further reports by mid-2006.

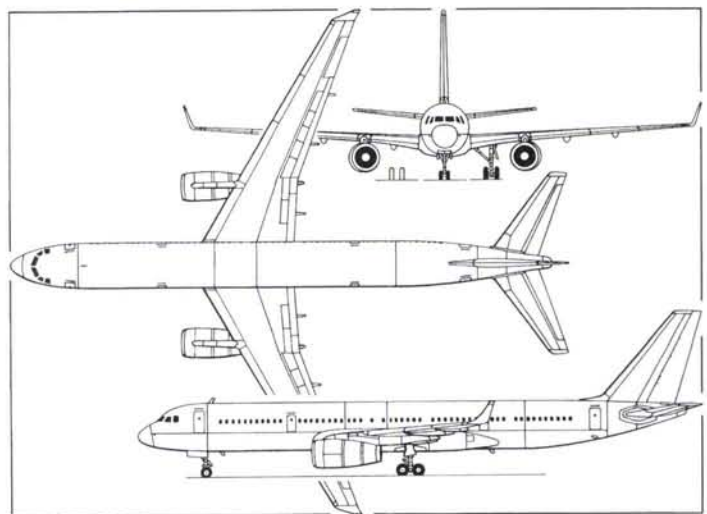
Tu-204K: Projected dual-fuel version. Previously known as Tu-204-600, then Tu-206. Inherits earlier experience gained in earlier Tu-136 and Tu-156 cryogenic propulsion programmes; 22,500 kg (49,604 lb) of liquefied natural gas (LNG) in conformal dorsal tanks, plus 5,500 kg (12,125 lb) Avgas in wings. Development stalled due to lack of funding.

Tu-214: Longer-range, increased-weight version of Tu-204-100, produced by KAPO. Prototype (RA-64501) rolled out at Kazan 5 February 1996; first flew 21 March 1996; public debut at Farnborough Air Show, September 1996. Provisional certification awarded 1998, PW2037 being assessed as an alternative to PS-90A. By early 2000, Kazan stock included seven partly complete Tu-214s from initial production batch of 18. Flight testing of prototype suspended after some 300 sorties, but resumed in May 2000 with further series of 85 flights leading to 'second class' AP-25 certification in March 2000 and full approval on 29 December 2000. First of two aircraft for Dal'avia (s/n 64502) made its first flight on 10 April 2001, and was delivered on 23 May 2001, for service on routes between Moscow and Asia; second received 20 October 2001. Prototype scheduled to flight test modified (quieter) version of PS-90A engine during 2006, to meet ICAO Chapter IV Appendix 16 noise level criteria.

Tu-214F: (previously Tu-214C or Tu-214-200C): Dedicated cargo version (30 t capacity); 3.405 × 2.18 m (11 ft 2 in × 7 ft 1 3/4 in) door. Prototype assembly expected to begin in 2005; Aviat (four ordered) is reported launch customer.

Tu-214ON: 'Open Skies' (*otkrito nebo*) surveillance version. One ordered by Russian government.

Tu-214SR: Radio relay (*samolet retranslator*) version. Two ordered by Russian government; deliveries due late 2006 and second quarter 2007.



Tupolev Tu-204-200 medium-range transport (two Aviadvigatel PS-90A turbofans) (Mike Keep)

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Tu-214VSSN: VVIP version (*vozdushnoe sudno specialnogo naznacheniya*) for Russian President. Fourth production Tu-214 (RA-64504) is in this configuration; first flight 22 June 2002.

CUSTOMERS: Total of approximately 38 production and four prototypes had flown by late 2006. There have been many more commitments and announced intentions which have failed to materialise. According to KAPO announcements in 2003, orders for the Tu-214 were received during the year from the Russian MoD (three), GTK Rossiya (three), Dal'avia (two), Omskavia (four), Aviast (four, including one cargo), and the Bulgarian carriers Air Sofia and BH Air (total of four). Four Iranian airlines (Aria, Caspian, Iran Air Tours and Kish Air) placed an order for 20 Tu-204-100s in April 2004. Delivery of five Tu-204-120CEs ordered by China in 2001 was planned to take place in 2006-07; first (B-2879) was awaiting hand-over in November 2006. Newly reported customers in early 2006 included Cubana (two Tu-204-100s and a Tu-204C) and a new Bahraini start-up airline (three Tu-214s). Russian sources report that 2005 deliveries comprised one Tu-214 to Dal'avia and four Tu-204-300s to Vladivostok Avia.

Many early Tu-204s have changed ownership since delivery. In addition, Tupolev has four aircraft, while two were used only for static testing. KMV (Kaminvodyavia) aircraft owned by Perm engine plant, which took two Tu-204s in lieu of cash payment for PS-90s; one Perm aircraft sold to Sibir in December 1999. Siberia Airlines also planning to acquire three Tu-214s from Kazan line.

COSTS: With PS-90 engines and Russian avionics USD27 million (2001); with RB211-535 engines USD38 million (1996).

DESIGN FEATURES: Conventional low/mid-wing configuration, with all surfaces swept back, and winglets; wing dihedral from roots; semi-monocoque oval section pressurised fuselage; torsion box of fin forms integral fuel tank, used for automatic trimming of CG in flight; design life 45,000 flights, 60,000 flight hours or 20 years.

Wing section supercritical; sweepback 28°; thickness/chord ratio 14 per cent at root, 9 to 10 per cent at tip; negative twist.

FLYING CONTROLS: Triplex digital fly-by-wire, with triplex analogue back-up; conventional 'Y' control yokes selected after evaluation of alternative sidestick on Tu-154 testbed; inset aileron outboard of two-section double-slotted flap on each wing trailing-edge; two-section upper surface airbrake forward of each centre-section flap; five-section spoiler forward of each outer flap; four-section leading-edge slat over full span of each wing; conventional rudder and elevators; no tabs.

STRUCTURE: Approximately 18 per cent of airframe by weight of composites; three-piece two-spar wing, with metal structure, part composites skin; carbon fibre skin on spoilers, airbrakes and flaps; glass fibre wingroot fairings; all-metal fuselage, utilising aluminium-lithium and titanium; nose radome and some access panels of composites; extensive use of composites in tail unit, particularly for leading-edges of fixed surfaces and for rudder and elevators.

LANDING GEAR: Hydraulically retractable tricycle type; electrohydraulically steerable twin-wheel nose unit ($\pm 10^\circ$ via rudder pedals; $\pm 70^\circ$ by electric steering control) retracts forward; four-wheel bogie main units retract inward into wing/fuselage fairings. Rubin KT-196 wheels on all units. Carbon disc brakes, electrically controlled. Tyre size 1,070x390 on mainwheels, 840x290 on nosewheels. Original Russian (NIISHP) or Goodyear radial tyres progressively replaced from 2000 by Michelin M12601-01 type.

POWER PLANT: 204-100, 204C, 204-300, 214: Two 158 kN (35,582 lb st) Aviadvigatel PS-90A turbofans, underwing in composites cowlings. Longer-life PS-90A2 under development for eventual retrofit.

204-120: Two 189 kN (42,580 lb st) Rolls-Royce RB211-535B75 turbofans.

Tu-204-200 series carries fuel in six integral tanks in wings, in centre-section and adjacent baggage hold, and in tailfin, total capacity 40,730 litres (10,760 US gallons;

TUPOLEV Tu-204/214 PRODUCTION
(at late-2006)

Line No.	Srs	Registration	Operator or fate
Tu-204			
1	P	RA-64001	Storage at Zhukovsky
2		nil	Static test
3	P	RA-64003	Storage at Zhukovsky
4	P	RA-64004	Storage at Zhukovsky
5		nil	Scrapped at Novosibirsk (fatigue test)
6	204	RA-64006	Storage at Ulyanovsk (Aviastar)
7	204	RA-64007	Storage at Vnukovo (Vnukovo)
8	C	RA-64008	Derelict at Vnukovo (Vnukovo)
9	C	RA-64009	Storage at Ulyanovsk (Vnukovo)
10	100C	RA-64010	Storage at Ulyanovsk (Vnukovo)
11	100	RA-64011	Avialiny 400
12		RA-64012	Storage at Ulyanovsk (Vnukovo); for scrap
13	100	RA-64013	Storage at Ulyanovsk (Vnukovo)
14	100	RA-64014	Grounded at Bykovo
15	100	RA-64015	Grounded at Bykovo
16	100	RA-64016	Kavminvodyavia (KMV)
17	100	RA-64017	Sibir
18	100	RA-64018	Kras Air
19	100	RA-64019	Kras Air
20	100	RA-64020	Kras Air
21	C	RA-64021	Air Rep
22	100	RA-64022	Kavminvodyavia (KMV)
23	120	SU-EAH	Air Cairo
24	100C	LY-AGT	Aviastar
25	120	SU-EAI	Air Cairo
26	300	RA-64026	Vladivostok Avia
27	120	SU-EAF	Air Cairo
28	120C	SU-EAG	Air Cairo
29	120C	SU-EAJ	Air Cairo
30	120CE	B-2871	Air China Cargo
31	120CE	RA-64031	Air China Cargo; incomplete
32	C	RA-64032	Air Rep
33		SU-EAK	Assigned Sirocco/Heavylift but assembly suspended
34	120CE	nil	Air China Cargo; incomplete
35	120CE	nil	China Eastern Cargo; incomplete
36		RA-64036	Cubana; incomplete
37	120CE	RA-64037	Cubana; incomplete
38	300	RA-64038	Vladivostok Avia
39	300	RA-64039	Vladivostok Avia
40	300	RA-64040	Vladivostok Avia
41	120CE		China Eastern Cargo; incomplete
Tu-214			
001	P	RA-64501	Tupolev
002	200	RA-64502	Dal'avia
003	200	RA-64503	Dal'avia
004	200	RA-64504	Rossiia
005	200	RA-64505	Rossiia
006	200	RA-64506	Rossiia
007	200	RA-64507	Dal'avia
008	200	RA-64508	Kras Air
009	200	RA-64509	Transaero
010	200	RA-64510	Dal'avia
011	200	RA-64511	Russian Air Forces (Tu-204ON)
012	200	RA-64512	Dal'avia
013	200	RA-64513	Transaero
014	200	RA-64514	Transaero
015	200	RA-64515	(VIP interior)
016	200	RA-64516	Transaero
017	200	RA-64517	Rossiia (VIP interior)
018	200	RA-64518	Transaero
019	200	RA-64519	Transaero
020	200	RA-64520	Transaero
021	200	RA-64521	Transaero
022	200	RA-64522	Transaero
023	200	RA-64523	(VIP interior)
024	200	RA-64524	Transaero
025	200	RA-64525	(VIP interior)



First Tupolev Tu-204-120CE freighter for China

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8,960 Imp gallons); torsion box of fin forms integral fuel tank for automatic trimming of CG in flight, as well as for optional standard use. See under Weights and Loadings for other fuel quantities.

ACCOMMODATION: Can be operated by pilot and co-pilot, but Aeroflot specified requirement for a flight engineer; provision for fourth seat for instructor or observer.

Standard passenger interiors are as detailed below, but other layouts are optional, configured to customer's requirements. All versions have passenger doors at front and rear of cabin on port side, with service doors opposite; Type 1 emergency exits fore and aft of wing each side; and inflatable slide for emergency use at each of the eight doors. Underfloor baggage/freight holds forward and aft of wing.

Tu-204-100/-120 series: Four basic single-aisle passenger arrangements, as follows: (1) 160 seats, with 24 business class four-abreast at pitch of 102 cm (40 in) at front and 136 economy class six-abreast at 84 cm (33 in) pitch at rear; (2) 175 seats, with 12 business class four-abreast at 105 cm (41 in) pitch at front plus 163 economy six-abreast at 81 cm (32 in) to rear; (3) 183 seats, comprising 24 business four-abreast at 102 cm (40 in) in front, with 159 economy six-abreast at 81 cm (32 in) in rear; and (4) 210 all-economy seats six-abreast at 81 cm (32 in) pitch. All four configurations have galley and lavatory immediately aft of flight deck, with a further two galleys, two lavatories and a wardrobe at rear of passenger accommodation. Additionally, 160- and 175-seat layouts have a further galley, lavatory, wardrobe and buffet at front of economy cabin.

Tu-204-300: Two standard layouts currently offered, namely: (1) 136 seats in two-class interior, comprising 24 four-abreast business class at 102 cm (40 in) with 112 economy six abreast at 81 cm (32 in) pitch to rear; or (2) 162 all-economy, six-abreast at 81 cm (32 in). Galley and lavatory immediately aft of flight deck, plus two galleys and a wardrobe at extreme rear of passenger cabin. All-economy version has two more lavatories behind rear row of seats; in two-class version, one of these is replaced by a wardrobe, with a second and third wardrobe situated between the business and economy class areas.

Tu-214: All-economy class, details as for Tu-204-100/-120 option 4. Alternative two-class interior seating 164 passengers: 24 business class four-abreast at 102 cm (40 in) and 140 economy class six-abreast at 84 cm (33 in) pitch.

Tu-204C and Tu-214F: Main cabin can accommodate 13 2.24 x 2.74 or 2.24 x 3.18 m (88 x 108 or 88 x 125 in) pallets, or 12 2.44 x 3.18 m (96 x 125 in) pallets, in each case with additional 1.35 x 2.24 m (53 x 88 in) AEP containers at rear. Underfloor holds can accommodate a total of eight LD3-46 international class or AK-07 containers (three in forward hold, five in rear hold). Fully automatic container loading system with manual back-up.

SYSTEMS: Triplex fly-by-wire digital control system, with triplex analogue back-up; Boreo Display Systems selected in 2000 to supply FMS computers. Three independent hydraulic systems, pressure 207 bar (3,000 lb/sq in). Ailerons, elevators, rudder, spoilers and airbrakes operated by all three systems; flaps, leading-edge slats, brakes and nosewheel steering operated by two systems; landing gear retraction and extension by all three systems. Electrical power supplied by two 200/115 V 400 Hz AC generators and a 27 V DC standby system. Type TA-12-60 APU in tailcone.

AVIONICS: Avionics of Russian design or, optionally, integrated by Thales or Honeywell, with standard nav/com equipment by Rockwell Collins.

Comms: VHF and HF radio, intercom.

Radar: Weather radar.

Flight: KSPNO-204 triplex automatic flight control and navigation system (being upgraded in 2002). VOR, DME, automatic approach and landing system, for operation to ICAO Cat. IIIa minima; Series 100/200 have RLG INS (Litton LTN-101 or Honeywell HG1150BD02), GPS (Litton LTN-2001) and TCAS II (Honeywell).

Instrumentation: EFIS equipment comprises two colour CRTs for flight and nav information for each pilot, plus two central CRTs for engine and systems data. All six to have been replaced by LCDs by end of 2002.

DIMENSIONS, EXTERNAL:

Wing span	40.88 m (134 ft 1½ in)
Wing aspect ratio	9.1
Length overall: except 204-300	46.14 m (151 ft 4½ in)
204-300	40.19 m (131 ft 10¼ in)
Fuselage: Max width	3.80 m (12 ft 5½ in)
Max depth	4.10 m (13 ft 5½ in)
Height overall	13.87 m (45 ft 6 in)
Tailplane span	15.00 m (49 ft 2½ in)
Wheel track	7.82 m (25 ft 8 in)
Wheelbase: except 204-300	17.00 m (55 ft 9¼ in)
Passenger doors (each): Height: all	1.85 m (6 ft 0¾ in)
Width: all	0.84 m (2 ft 9 in)
Service doors (each): Height: all	1.60 m (5 ft 3 in)
Width: all	0.65 m (2 ft 1½ in)
Cargo door (appropriate versions):	
Height	2.18 m (7 ft 1¾ in)
Width	3.405 m (11 ft 2 in)
Emergency exit doors (each):	
Height: all	1.44 m (4 ft 8¾ in)
Width: all	0.61 m (2 ft 0 in)
Baggage holds:	
Height to sill: all	2.71 m (8 ft 10¾ in)

DIMENSIONS, INTERNAL:

Cabin, excl flight deck:	
Length: except 204-300	30.18 m (99 ft 0 in)
Max width: all	3.57 m (11 ft 8½ in)
Max height: all	2.28 m (7 ft 6 in)
Fwd cargo hold:	
Height: all	1.16 m (3 ft 9¾ in)
Volume: 204-100/-120, 204C	11.0 m³ (388 cu ft)
204-300	7.4 m³ (261 cu ft)
Rear cargo hold:	
Height: 204-100/-120, 204C, 214	1.16 m (3 ft 9¾ in)
Volume: 204-100/-120, 204C	15.4 m³ (544 cu ft)
204-300	20.4 m³ (720 cu ft)
Cargo compartment bulk volume:	
204C	44.5 m³ (1,572 cu ft)

AREAS:

Wings, gross: all	184.20 m² (1,982.7 sq ft)
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Tupolev Tu-204-300 twin-jet airliner (Yefim Gordon)

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WEIGHTS AND LOADINGS:

Operating weight empty: 204-100	58,800 kg (129,630 lb)
204-120	59,000 kg (130,075 lb)
204C	59,500 kg (131,175 lb)
Max fuel weight: 204-100/-120, 204C	32,800 kg (72,312 lb)
204-300 short range	24,500 kg (54,013 lb)
204-300 mid/long range	36,000 kg (79,366 lb)
214	35,710 kg (78,727 lb)
Max payload: 204-100/-120	21,000 kg (46,297 lb)
204-120CE	30,000 kg (66,139 lb)
204C	27,000 kg (59,525 lb)
204-300 short/mid range	18,000 kg (39,683 lb)
204-300, long range	13,600 kg (29,983 lb)
214	25,200 kg (55,556 lb)
Max T-O weight:	
204-100/-120, 204C	103,000 kg (227,075 lb)
204-300, short range	96,000 kg (211,645 lb)
204-300, mid range	105,000 kg (231,485 lb)
204-300, long range	107,500 kg (236,995 lb)
214	110,750 kg (244,160 lb)
Max landing weight: except 214	88,000 kg (194,005 lb)
214	93,000 kg (205,030 lb)
Max zero-fuel weight: 214	86,000 kg (189,595 lb)
Max wing loading:	
204-100/-120, 204C	559.2 kg/m ² (114.53 lb/sq ft)
204-300, short range	521.2 kg/m ² (106.74 lb/sq ft)
204-300, mid range	570.0 kg/m ² (116.75 lb/sq ft)
204-300, long range	583.6 kg/m ² (119.53 lb/sq ft)
214	601.2 kg/m ² (123.15 lb/sq ft)
Max power loading:	
204-100, 204C	325 kg/kN (3.19 lb/lb st)
204-120	272 kg/kN (2.67 lb/lb st)
204-300, short range	303 kg/kN (2.97 lb/lb st)
204-300, mid range	332 kg/kN (3.25 lb/lb st)
204-300, long range	340 kg/kN (3.33 lb/lb st)
214	350 kg/kN (3.43 lb/lb st)

PERFORMANCE:

Nominal cruising speed at FL364-397:	
all	437–459 kt (810–850 km/h; 503–528 mph)
Approach speed:	
204-300, short range MTOW	119 kt (220 km/h; 137 mph)
204-300, mid range MTOW	122 kt (225 km/h; 140 mph)
Max cruising height: all	12,100 m (39,700 ft)
T-O run: 204-100, 204C	1,760 m (5,775 ft)
204-300	2,000 m (6,565 ft)
T-O field length: 204-100/-120	2,250 m (7,385 ft)
204C, 214	2,500 m (8,205 ft)
Landing run: 204-100, 204C	2,160 m (7,090 ft)
204-300	2,000 m (6,565 ft)
Range with max payload: 204-100	2,321 n miles (4,300 km; 2,671 miles)
204C	1,684 n miles (3,120 km; 1,938 miles)
204-300	3,023 n miles (5,600 km; 3,479 miles)
Range with max fuel:	
204-100/-120, 210 passengers	2,645 n miles (4,900 km; 3,044 miles)
204-100, 12 t payload	3,671 n miles (6,800 km; 4,225 miles)
204C, 13.5 t payload	3,779 n miles (7,000 km; 4,349 miles)
204-300 short range, 162 passengers	1,619 n miles (3,000 km; 1,864 miles)
204-300 mid range, 162 passengers	3,131 n miles (5,800 km; 3,603 miles)
204-300 long range, 120 passengers	4,589 n miles (8,500 km; 5,281 miles)
214, 13.5 t payload	3,887 n miles (7,200 km; 4,473 miles)

TUPOLEV Tu-324 and Tu-414

TYPE: Regional jet airliner.

PROGRAMME: Announced at 1995 Paris Air Show; proposed manufacture by KAPO at Kazan, Tatarstan, from 2003. Specification revised 1996 and further refined in 1997 when governments of Russia and Tatarstan agreed on 20 August to 50:50 sharing of development costs, to which latter had contributed some USD70 million by late 2002. Tatarstan placed symbolic first order for a presidential transport (since superseded by Tu-214 VSSN, which see). Mockup completed by late 1997; technical documentation issued 2000. Both versions entered for 2002–03 national RRJ competition staged by Rosaviacosmos and eventually won by Sukhoi. Tupolev and KAPO planned to continue development provided non-federal funding can be found; reported in March 2003 that Tu-324 had by then been allocated some USD38 million in state funding. Further investment of USD70 million by Tatarstan government reported in July 2003, coupled with statement that prototype manufacture was about to begin. However, Tupolev spokesman confirmed in February 2004 that Tu-324 progress had been halted following loss of RRJ contract, and attention now focused on Tu-414 variant, which was continuing in 2005-06.

CURRENT VERSIONS: **Tu-324A:** (*Administrativny*; executive) VIP transport, carrying up to 10 passengers. In abeyance.

Tu-324R: Regional airliner: 52 seats in single-class configuration: 10 + 34 or 36 in two-class. In abeyance.

Tu-414: Stretched, 58/72-seat airliner, with Rolls-Royce BR710-48 turbofans. Initial design completed December 2003; 'electronic mockup' planned for first half of 2004. Maximum commonality with Tu-324. Described in 2006 company literature as "basic aircraft in the Russian regional aircraft family". *Description applies to this version.*

COSTS: Tu-414 estimated total programme cost USD300 million (2005), including three flying prototypes and two static/fatigue test airframes. Projected unit cost approximately USD16 million.

DESIGN FEATURES: Wings scaled down from Tu-204; TsAGI (CAHI) improved aerofoil section; illustrations show the aircraft with and, more recently, without winglets. Is first Russian aircraft programme designed entirely with use of computers. Design service life of 60,000 flight hours, 40,000 flights or 30 years.

FLYING CONTROLS: Digital fly-by-wire with standby analogue 'critical conditions' warning system. Three-segment spoilers forward of two-segment slotted flaps.

LANDING GEAR: Tricycle type; retractable. Twin wheels on each unit.

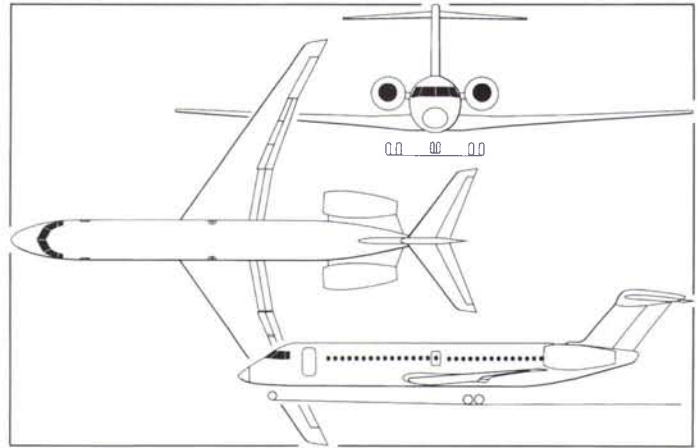
POWER PLANT: Two approx 68.9 kN (15,500 lb st) Rolls-Royce BR710-48 turbofans with FADEC, pod-mounted to pylons on sides of rear fuselage.

ACCOMMODATION: Flight crew of two, plus two cabin attendants. Standard all-economy class seating for 72 passengers at 81 cm (32 in) pitch with two galleys and lavatory forward plus



Artist's impression of Tupolev Tu-414

1158635



Tupolev Tu-414 twin-turboprop regional jet airliner (Paul Jackson)

1158670

second lavatory aft. Alternative layouts for 68 passengers (28 de luxe seats at 94 cm; 37 in and 40 economy at 81 cm; 32 in), or 58 seats (six business class at 119 cm; 47 in and 52 economy at 81 cm; 32 in); all seats four-abreast, with central aisle. Also offered with four- or 19-passenger VIP interiors. Passenger airstair door forward, with service door opposite; overwing emergency exit each side. Underfloor baggage/cargo holds forward and aft of wing; additional (to overhead bins) carry-on baggage area at rear of cabin.

AVIONICS: Integrated, all-digital airborne systems including aircraft and power plant controls, flight controls, PA and IFE systems, onboard control systems monitoring, and operational status of all aircraft systems and components.

DIMENSIONS, EXTERNAL:

Wing span	27.70 m (90 ft 10½ in)
Length overall	31.765 m (104 ft 2½ in)
Height overall	8.295 m (27 ft 2½ in)
Wheelbase	14.15 m (46 ft 5 in)
Baggage door sill height:	
front	1.05 m (3 ft 5¼ in)
rear	1.15 m (3 ft 9¼ in)

DIMENSIONS, INTERNAL:

Passenger cabin:	
Max height	1.92 m (6 ft 3½ in)
Aisle width	0.50 m (1 ft 7¾ in)
Baggage/cargo compartment volume:	
front	6.9 m ³ (244 cu ft)
rear	3.6 m ³ (127 cu ft)

WEIGHTS AND LOADINGS:

Max fuel weight	12,000 kg (26,455 lb)
Max payload	8,000 kg (17,637 lb)
Max T-O weight	38,380 kg (84,613 lb)

PERFORMANCE (estimated):

Cruising speed	475 kt (880 km/h; 547 mph)
Max operating altitude	12,100 m (39,700 ft)
T-O/landing field length	1,800 m (5,905 ft)
Range with max payload	1,889 n miles (3,500 km; 2,174 miles)

TUPOLEV Tu-330

TYPE: Twin-jet freighter.

PROGRAMME: Announced early 1993 as replacement for Antonov An-12; government support announced 23 April 1994; first 10 to be built at Kazan; first flight scheduled 1997, for service from 1998; neither target achieved. Production at both KAPO and Samara. Stated by commander of Russian Military Transport Aviation to be one of three basic types to be operated by his force in 21st century. Production drawings released by Tupolev to KAPO at Kazan in late 1997 and construction then begun. By early 2000 the venture was being offered as a potential partnership.

Tu-330 included in federal plans for civil aviation up to 2015, requiring investment of equivalent of USD340 million over seven years. Tupolev expenditure to early 2000 totalled RUR80 million. Kazan plant hoped for production launch in 2002, but funding still awaited in mid-2006. However, Russian Air Forces' reluctance to accept An-70 seen to improve Tu-330's chances of go-ahead, and named in 2003 as one of two main contenders (with Il-214) to replace An-12. No further reports by mid-2006.

CURRENT VERSIONS: **Tu-330:** *As described.*

Tu-330K (previously Tu-338): Proposed cryogenic-fuelled version with Samara NK-94 engines and 22,600 kg (49,824 lb) of liquid natural gas in conformal dorsal tank. Technical proposals completed, but not yet funded (mid-2006).

COSTS: Unit price USD25 million to USD35 million (2000, estimate). Estimated cost of two flying and two ground test aircraft, plus certification, USD100 million (2003).



Model of proposed Tupolev Tu-330 with PS-90A engines (Paul Jackson)

1047205

DESIGN FEATURES: See accompanying three-view drawing: said to have up to 75 per cent commonality with Tu-204. Wing design basically similar to Tu-204; engine pylons as Tu-204; rear-loading ramp. Potential secondary applications include refuelling tanker and maritime patroller.

FLYING CONTROLS: Each wing has four-section leading-edge flaps, three-section trailing-edge flaps, eight spoilers forward of flaps, and aileron. Variable incidence tailplane. Elevators and rudder each in two sections.

LANDING GEAR: Retractable tricycle type; twin-wheel, rearwards-retracting nose unit; each main unit has three pairs of wheels (one pair with brakes) in tandem. Able to operate from concrete or grass.

POWER PLANT: Two Aviadvigatel PS-90A turboprops. Rolls-Royce and Pratt & Whitney turboprops under consideration for export sales. Tu-330K is projected for LNG transportation, with three tanks in the cabin for 22,800 kg (50,265 lb) of LNG.

ACCOMMODATION: Flight crew of two.

AVIONICS: Include six colour MFDs.

DIMENSIONS, EXTERNAL:

Wing span over winglets	42.28 m (138 ft 8½ in)
Wing aspect ratio	10.1
Length overall	42.00 m (137 ft 9½ in)
Fuselage max diameter	5.30 m (17 ft 4¼ in)
Height overall	14.00 m (45 ft 1¼ in)
Rear-loading ramp: Length	4.00 m (13 ft 1½ in)
Width	4.00 m (13 ft 1½ in)

DIMENSIONS, INTERNAL:

Cargo hold:	
Length: excl ramp	19.50 m (63 ft 11½ in)
incl ramp	23.50 m (77 ft 1¼ in)
Width at floor	4.00 m (13 ft 1½ in)
Height: min	3.55 m (11 ft 7¾ in)
max	4.00 m (13 ft 1½ in)
Volume	350.0 m³ (12,360 cu ft)

AREAS:

Wings, gross	177.80 m² (1,913.8 sq ft)
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WEIGHTS AND LOADINGS:

Payload: in hold	30,000 kg (66,139 lb)
on ramp	5,000 kg (11,023 lb)
max	35,000 kg (77,162 lb)
Max T-O weight	103,500 kg (228,175 lb)
Max wing loading	582.1 kg/m² (119.22 lb/sq ft)

PERFORMANCE (estimated):

Nominal cruising speed at FL360	431–458 kt (800–850 km/h; 497–528 mph)
T-O and landing distance	2,200 m (7,220 ft)
Nominal range:	
with 15,000 kg (33,069 lb) payload	3,779 n miles (7,000 km; 4,349 miles)

with 20,000 kg (44,090 lb) payload	3,020 n miles (5,600 km; 3,480 miles)
with 30,000 kg (66,139 lb) payload	1,620 n miles (3,000 km; 1,865 miles)

TUPOLEV Tu-334

TYPE: Twin-jet airliner.

PROGRAMME:

DEVELOPMENT MILESTONES

Launched	1986
Rolled out	25 Aug 95
First flight	8 Feb 99

Launched 1986, with target first flight in 1991 and service entry in 1995; chief designer Igor Kaligin. First prototype Tu-334 (RA-94001) eventually rolled out at Zhukovsky during Moscow Air Show, 25 August 1995; then scheduled to fly 1996 with D-436T1 engines, but delayed by funding shortages. Refinancing by Ukrainian government in early 1997 resulted in new target date of May/June 1997 for first Tu-334s built by Aviant at Kiev; this also missed; second and third identical, but non-flying, prototypes under construction at Zhukovsky by 1996; second (002) used for static tests at CAHI (TsAGI) 1996; test airframe 004 delivered to Aviatest LNK at Riga from Kiev in mid-2000 to simulate 20 year fatigue life; further two prototypes and three production aircraft under construction at Kiev by early 1999 (three for full assembly by Aviant; part of fuselage and wings of other two for delivery to RSK 'MiG' at Lukhovitsy). Subsequent input from Aviant of these components only, instead of originally planned second assembly line.

RA-94001 eventually flown 8 February 1999 and had achieved eight sorties by time of public debut at Moscow in August 1999. Plans for 200 flights in 2001 not achieved (114 only), and this total (of planned 900) not reached until late 2003. By mid-2003, second flying prototype (Aviant-built 005) said to be more than 90 per cent complete; was rolled out 2 August 2003; made maiden flight (RA-94005) on 21 November 2003 and delivered to Zhukovsky for flight trials 27 November. Completion of third development aircraft (003, first by RSK 'MiG'), anticipated by June 2003, but negated by Rosaviakosmos announcement in January 2004 allocating Tu-334 production to four-company consortium of KAPO, Aviant, Aviastar and Tavia (Taganrog). As of mid-2006, prototype 003 still unflown and KAPO production not yet started. Russian provisional certification of Tu-334-100 awarded 30 December 2003.

AP-25/FAR Pt 25 certification programme was due for completion in 2001, but victim of above-mentioned delays, created by erratic funding and delayed delivery of D-436 engines; full certification still awaited in mid-2006. TANTK at Taganrog was to have been second source for -100, but Russian government decree of 5 October 1999 nominated RSK 'MiG' (which is to contribute half of certification costs, first payment being made in January 2002); first Taganrog fuselage transported to Voronin Production Centre, Moscow, arriving 7 April 2000. Completion and final assembly was to have been in second quarter of 2001, but this not achieved (see above); Taganrog horizontal tail delivered early 2002. Half of all assemblies and components for RSK 'MiG' production to be supplied by Aviant; other components supplied by Kazan and Ulyanovsk factories. Approval for RSK 'MiG' production awarded 31 October 2002.

On 16 June 1997 Rolls-Royce Deutschland agreed loan of BR710 engines to build prototype of Tu-334-120; first flight of -120 had been expected late 1998, but delayed by funding shortages. Revised plans for BR710s to go into -100 prototype, after short test programme with D-436s, also thwarted by aircraft's continued grounding. R-R support now directed at versions powered by BR715 engines.

During mid-1997, AIO of Iran showed interest in establishing a kit assembly line at Esfahan for 100 Tu-334s (of which 50 for local airlines) over 15 years, based on eventual fuselage detailed assembly in Iran, with complete wings from Ukraine and empennage from Russia. No recent news received concerning this venture.

Five versions being promoted in 2003–06 were Tu-334-100, -100D, -120D, -200 and -220.

CURRENT VERSIONS: **Tu-334-100:** Basic version, with D-436T1 engines, for 72 mixed class or 102 tourist class passengers. Prototypes are of this version.

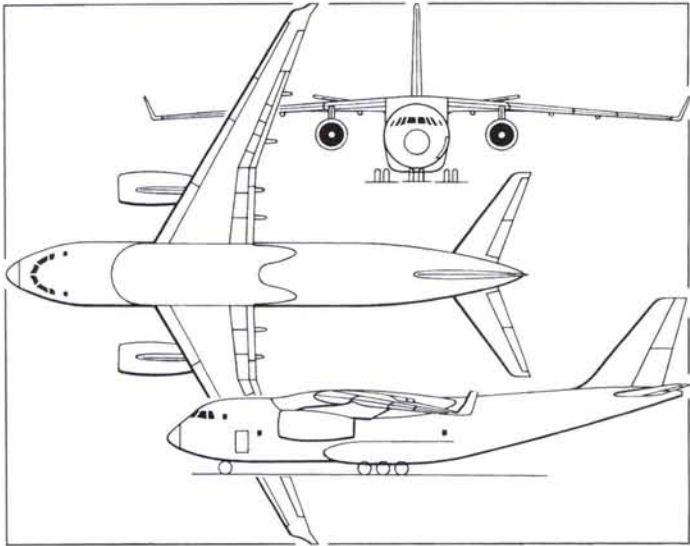
Tu-334-100C: Cargo version of -100; up to six 2.24 × 3.17 m (88 × 125 in) pallets in underfloor compartments.

Tu-334-100D: Extended-range 102-seat version, announced at Moscow Air Show '95. Basically similar to Tu-334-100, but with increased wing span and uprated D-436T2 engines; increased fuel and maximum T-O weight. Not yet built.

Tu-334-120: As Tu-334-100, but two 88.9 kN (19,995 lb st) Rolls-Royce BR715-56 turboprops. Third flying prototype to be in this configuration.

Tu-334-120D: Rolls-Royce BR715-56 engines; increased weight and range. Announced 1998.

Tu-334-200: Basically similar to Tu-334-100D and previously known as **Tu-354**; D-436T2 engines; fuselage lengthened by 3.90 m (12 ft 9½ in) to accommodate up to 126 passengers at 81 cm (32 in) pitch; increased wing span; four-wheel bogies on main landing gear units. Construction of four by Aviacor in Samara reportedly begun by early 1997, but

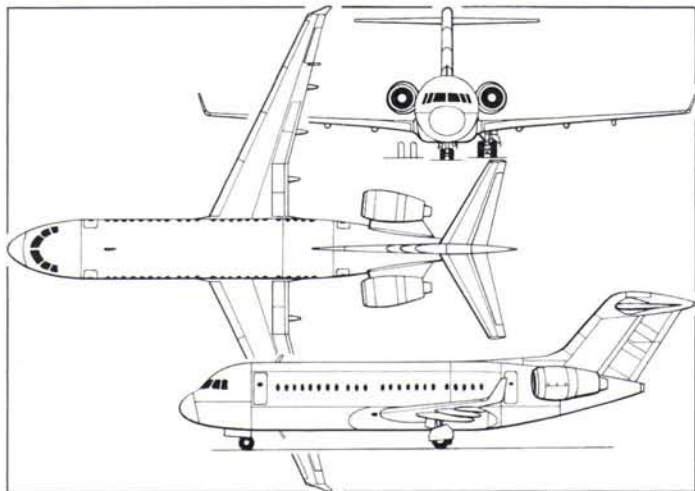


Tupolev Tu-330 twin-turboprop freight transport (Mike Keep)

1158571



Tupolev Tu-334 prototype 1158629



Tupolev Tu-334-100 twin-turboprop medium-range transport (James Goulding) 1158572

this apparently inaccurate and Aviacor connection with Tu-334 programme severed in 1999.

Tu-334-220: Further increased MTOW; BR715-56 engines. Announced 1998.

CUSTOMERS: Provisional orders in 1995 for approximately 40 aircraft, for Rossiya Airlines, Bashkiri Airlines, Tyumen Airlines and Tatarstan Airlines. MoU for 20 Tu-334-120s signed by Aeroflot in June 2000; other letters of intent from Atlant Soyuz (two) and Pulkovo (15 to 20) during first half of 2002. First firm orders (five Tu-334-100s each for 10-year lease by Aeroflot and Atlant Soyuz Airlines) announced by RSK 'MiG' at MAKs air show, August 2003. CIS market estimated as about 350 by Rosaviakosmos. Tupolev website reported orders from 12 airlines as at November 2003.

COSTS: Tu-334-100 USD16 million to USD18 million; Tu-334-200 USD20 million (both 2003). Break-even at 48th aircraft, according to RSK 'MiG'.

DESIGN FEATURES: Replacement for Tu-134 and Yak-42, to meet requirements of Russian Federation and Associated States (CIS) airlines. Wings have much in common with those of Tu-204 and the fuselage is shortened version of Tu-204, with identical flight deck. Configuration is all-swept low/mid-wing, with rear-mounted engines and T tail; circular-section semi-monocoque fuselage; wings have dihedral from roots. Short-stroke landing gear for minimal door sill height, to facilitate baggage handling at airports with limited loading capabilities. Service life 60,000 hours.

Wings have supercritical section, 24° sweepback, with winglets.

FLYING CONTROLS: Main and standby fly-by-wire; emergency hydraulic and mechanical back-up, except for ailerons. Two-section, single-slotted, trailing-edge flaps, two-section airbrakes forward of inner flap and two-section spoilers forward of outer flap on each wing; four-section leading-edge slat over full span each wing; conventional ailerons, elevators and two-section rudder; no tabs. Variable-incidence tailplane.

STRUCTURE: Composites and other lightweight materials make up 20 per cent of structure by weight. Metal alloy wing, fin and horizontal tail, each constructed on two spars, have composites leading-edges and covered by milled panels. Elevators, ailerons, airbrakes, spoilers, flaps, rudder and floor panels of composites honeycomb. Fuselage of metal alloy with riveted skin. Wings by Aviant at Kiev (Ukraine); final assembly by RSK 'MiG' at Lukhovitsy.

LANDING GEAR: Retractable tricycle type; twin wheels on each unit of Tu-334-100, four-wheel bogies on main units of Tu-334-200; main units retract inward into wing/fuselage fairings; trailing-link mainwheel legs on Tu-334-100; nosewheels retract forwards, forward elements of two-section door each side remaining closed except during cycling. Some recent Tupolev illustrations have shown all versions of Tu-334 with four-wheel main bogies. Tyre size 1,070x390-480R on mainwheels; 680x260-355R on nosewheels. Stout grille behind mainwheels of prototype to prevent ice and slush entering turboprops.

POWER PLANT: *Tu-334-100:* Two ZMKB Progress D-436T1 turboprops, each rated at 73.6 kN (16,535 lb st). Cascade-type thrust reversers.

Tu-334-100D/-200: Two D-436T2 turboprops, each rated at 80.4 kN (18,078 lb st).

Tu-334-120/-120D/-220: Rolls-Royce BR715-56 turboprops each rated at 88.9 kN (19,995 lb st). D-436T1 production by consortium of Motor-Sich at Zaporozhye (Ukraine), Salyut and UMPO.

Fuel in integral wing tanks, total capacity (Tu-334-100) 9,540 kg (21,032 lb) or (-100D/-120D/-200/-220) 15,700 kg (34,613 lb).

ACCOMMODATION (Tu-334-100 and -120): Crew of two (optionally three) on 'Tu-204 compliant' flight deck; provision for fourth seat for instructor or observer. Three basic single-aisle passenger arrangements: (1) 72 seats, with 12 seats four-abreast in first class cabin at front, at pitch of 102 cm (40 in) and with 73 cm (28.75 in) aisle, and 60 tourist class seats six-abreast at 81 cm (32 in) pitch with 49.5 cm (19.5 in) aisle; (2) 102 seats, all tourist, at 81 cm (32 in) pitch; and (3) 74 seats, with eight business class and 66 in economy class. All three configurations have buffet/galley, coat compartment and lavatory immediately behind flight deck, a further lavatory and service compartment at rear; 72-seater has additional galleys at front and rear; overhead stowage for hand baggage. Other arrangements

at customer's option. Passenger doors at front and rear of cabin on port side; service doors opposite. Underfloor baggage/freight holds; doors on starboard side.

ACCOMMODATION (Tu-334-200): Flight deck unchanged. Two basic single-aisle passenger arrangements: (1) 110 seats, with eight seats four-abreast in first class cabin at front, at pitch of 99 cm (39 in), and 102 tourist class seats six-abreast at 81 cm (32 in) pitch; (2) 126 seats, all tourist, at 81 cm (32 in) pitch. Facilities as Tu-334-100/120, plus emergency exit over wing each side.

SYSTEMS: APU in tailcone. Hydraulic system for actuation of flying controls. Air conditioning unit in wing centre-section.

AVIONICS: Radar: Nose-mounted weather radar.

Instrumentation: EFIS standard, with six CRTs. Satcom optional. Equipment for landings in ICAO Cat. IIIa conditions.

DIMENSIONS, EXTERNAL:

Wing span: 100, 120	29.77 m (97 ft 8 in)
100D, 120D, 200, 220	32.61 m (107 ft 0 in)
Wing aspect ratio: 100, 120	10.2
100D, 120D, 200, 220	10.6
Length overall: 100, 120, 120D	31.26 m (102 ft 6 1/4 in)
100D	31.76 m (104 ft 2 1/2 in)
200, 220	35.16 m (115 ft 4 1/2 in)
Fuselage: Max width	3.80 m (12 ft 5 1/2 in)
Max depth	4.10 m (13 ft 5 1/2 in)
Height overall: 100	9.38 m (30 ft 9 3/4 in)
100D	9.60 m (31 ft 6 in)
Tailplane span	11.12 m (36 ft 5 3/4 in)
Wheel track (c/l shock struts): all	4.80 m (15 ft 9 in)
Wheelbase: 100, 120	11.75 m (38 ft 6 3/4 in)
Baggage door:	
forward: Height	1.03 m (3 ft 4 1/2 in)
Width	1.165 m (3 ft 9 3/4 in)
Height to sill	1.26 m (4 ft 1 1/2 in)
rear: Height	0.95 m (3 ft 1 1/2 in)
Height to sill	0.93 m (3 ft 0 1/2 in)

DIMENSIONS, INTERNAL:

Cabin: Length: 100, 120	17.84 m (58 ft 6 1/4 in)
Height:	
above aisle: all	2.185 m (7 ft 2 in)
beneath hand baggage racks: all	1.70 m (5 ft 7 in)
Max width: all	3.57 m (11 ft 8 1/2 in)
Volume: 100, 120	118.0 m³ (4,167 cu ft)
Baggage holds:	
Max length: 100, 120, forward	4.10 m (13 ft 5 1/4 in)
100, 120, rear	3.00 m (9 ft 10 in)
Max width: 100, 120	2.50 m (8 ft 2 1/2 in)
Max height: 100, 120	1.20 m (3 ft 11 1/4 in)
Volume: 100, forward	11.7 m³ (413 cu ft)
Total volume: 100, 120	16.2 m³ (572 cu ft)
100D, 120D	15.8 m³ (558 cu ft)
200, 220	23.3 m³ (823 cu ft)

AREAS:

Wings, gross: 100, 120	83.23 m² (895.8 sq ft)
100D, 120D, 200, 220	100.0 m² (1,076.4 sq ft)

WEIGHTS AND LOADINGS:

Operating weight empty: 100	28,950 kg (63,824 lb)
100D	31,920 kg (70,371 lb)
120D	32,320 kg (71,253 lb)
200	33,975 kg (74,902 lb)
220	34,325 kg (75,674 lb)
Design payload:	
100, 100D, 120D	9,690 kg (21,363 lb)
200, 220	11,970 kg (26,389 lb)
Max payload:	
100, 100C, 100D, 120, 120D	9,690 kg (21,363 lb)
200, 220	15,000 kg (33,069 lb)
Max fuel weight: 100	10,350 kg (22,818 lb)
100D, 120D, 200, 220	15,700 kg (34,613 lb)
Max T-O weight: 120, 120C	46,100 kg (101,630 lb)
100	47,900 kg (105,600 lb)
120D	53,750 kg (118,498 lb)
100D	54,420 kg (119,975 lb)
200	54,470 kg (120,085 lb)
220	54,800 kg (120,815 lb)
Max landing weight: 100	43,500 kg (95,900 lb)
100D	44,600 kg (98,326 lb)
Max wing loading:	
120D	537.5 kg/m² (110.09 lb/sq ft)
120	553.9 kg/m² (113.44 lb/sq ft)
100	575.5 kg/m² (117.87 lb/sq ft)
200	544.7 kg/m² (111.56 lb/sq ft)
100D, 120D	544.2 kg/m² (111.46 lb/sq ft)
220	548.0 kg/m² (112.24 lb/sq ft)
Max power loading: 100	325 kg/kN (3.19 lb/lb st)
120	334 kg/kN (3.27 lb/lb st)
100D	338 kg/kN (3.31 lb/lb st)
120D	302 kg/kN (2.96 lb/lb st)
200	339 kg/kN (3.32 lb/lb st)
220	308 kg/kN (3.02 lb/lb st)

PERFORMANCE (estimated):

Nominal cruising speed at FL360: 100, 100D, 200	431-442 kt (800-820 km/h; 497-510 mph)
Normal operating altitude	11,100 m (36,420 ft)
Balanced runway length at 30°C:	
100	2,100 m (6,890 ft)
Range with max payload, 60 min reserves:	
100	1,101 n miles (2,040 km; 1,267 miles)
100D	1,630 n miles (3,020 km; 1,876 miles)
120D	1,544 n miles (2,860 km; 1,777 miles)
200	529 n miles (980 km; 608 miles)
220	448 n miles (830 km; 515 miles)
Range with design payload:	
100, 100C	1,700 n miles (3,150 km; 1,957 miles)

100D, 120D	2,213 n miles (4,100 km; 2,547 miles)
120	1,685 n miles (3,122 km; 1,939 miles)
200, 220	1,187 n miles (2,200 km; 1,367 miles)

OPERATIONAL NOISE LEVELS (ICAO, estimated):

T-O	85.8 EPNdB
Approach	97.4 EPNdB
Sideline	92.0 EPNdB

TUPOLEV Tu-444

TYPE: Supersonic business jet.

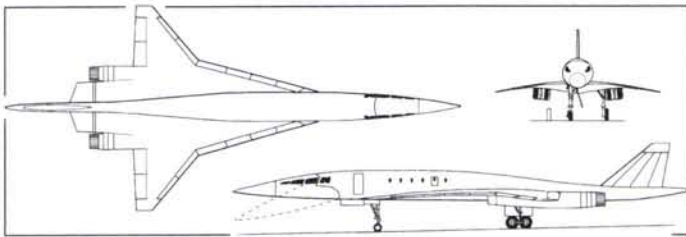
PROGRAMME: Design concept completed by December 2003; development planned to begin in first half of 2004, subject to obtaining start-up funding. Subscale supersonic passenger aircraft (SPS) as first stage towards prospective international (Europe-wide), large-capacity (provisionally SPS-2) supersonic transport.

COSTS: Approximately USD1 billion estimated to develop Tu-444; unit cost (target) USD50 million.

DESIGN FEATURES: Tail-less delta; area-ruled fuselage; low-mounted wing with large root strakes. All-flying, single-fin vertical tail. Pitch- and laterally statically unstable with FBW control. Nose droops for take-off and landing. Wing has elevons drooped during take-off and landing and adaptive deflectable leading-edges. Powerful trailing-edge trimming surfaces. May feature retractable nose multislot destabiliser similar to that of Tu-144.

Adaptive leading-edges designed to improve aerodynamic quality (L/D ratio) might not be used at the initial stage of demonstrator flight test. Wing characterised by mid-surface deformation and by geometric and aerodynamic twist along the span; aerofoil thickness ratio changes spanwise from 2.5 to 3.5 per cent. Saw-tooth leading-edge is also integral fuel tank. Wingroot houses main landing gear legs and wheel wells between engine nacelles.

Blended engine pods below wing surface have controlled air intakes for supersonic flight



Provisional general arrangement of Tupolev Tu-444 supersonic business jet
(Paul Jackson)

1158573

UNIKOMTRANSO

UNIKOMTRANSO AO

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GENERAL DIRECTOR: Oleg N Voronkov

Established 1990 as Unikomtrans, a production co-operative operating an An-12 and An-74 on air freight operations, although involved in producing air cushion vehicles since 1983. Became Unikomtranso AO on 6 April 1994 and made first issue of shares in 2000. Business includes

with vertical ramp which is scaled copy of Tu-160 units. Turbofans moved aft from under torsion box and turned slightly upwards so rear fuselage and fin act as shields to cut down side noise level during take-off run. To obtain maximum flight test data, demonstrator will be fitted with afterburning turbofans.

FLYING CONTROLS: Fly-by-wire.

STRUCTURE: The fuselage divided into three parts: (a) nose, pressurised fuselage with cockpit, equipment compartments, mainwheel wells, entrance vestibule and coat room, galley, in-built folded stairs, passenger compartment and lavatory; (b) mid-portion with integral fuel tank and air-conditioning system; (c) tail section with electrical and hydraulic system and APU compartments.

LANDING GEAR: Tricycle type; retractable. Nose gear offset to starboard. Mainwheels retract inwards; nosewheel forward.

POWER PLANT: Two non-reheated NPO Saturn AL-42 turbofans, based on military AL-31F/AL-41F-1, each 95.1 kN (21,385 lb st).

ACCOMMODATION: Two pilots; one steward; and six passengers. Optionally, 10 passengers and reduced range. Forward windscreen covered by raised nosecone when in high-speed flight; side windows only in nosecone.

AVIONICS: Demonstrator's flight and navigation equipment of open architecture design for later augmentation and transfer to production aircraft.

DIMENSIONS, EXTERNAL:

Wing span	16.20 m (53 ft 1 3/4 in)
Wing aspect ratio	1.9
Length overall	36.00 m (118 ft 1 1/4 in)
Max diameter of fuselage	2.28 m (7 ft 5 3/4 in)
Height overall	6.51 m (21 ft 4 1/4 in)
Wheel track	4.41 m (14 ft 5 1/2 in)
Wheelbase	11.04 m (36 ft 2 3/4 in)
Door height to sill	2.85 m (9 ft 4 1/4 in)

DIMENSIONS, INTERNAL:

Cabin: Max height	1.95 m (6 ft 4 3/4 in)
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AREAS:

Wings, gross	136.0 m ² (1,463.9 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	19,300 kg (42,549 lb)
Max payload	6,000 kg (13,228 lb)
Max fuel weight	20,500 kg (45,195 lb)
Max T-O weight	41,000 kg (90,389 lb)
Max wing loading	301.5 kg/m ² (61.75 lb/sq ft)
Max power loading	215.50 kg/kN (2.11 lb/lb st)

PERFORMANCE (estimated):

Cruising speed: supersonic	M2.0 (1,147 kt; 2,125 km/h; 1,320 mph)
subsonic	567 kt (1,050 km/h; 652 mph)
Required runway length	1,830 m (6,005 ft)
Range with NBAA reserves	3,779 n miles (7,000 km; 4,349 miles)

aircraft upgrades, light aircraft design, construction of lightplane prototypes and flight- and technical training on light aircraft. Manufacture in series assigned to Progress Scientific & Technical Complex under agreement of 16 March 2000.

First aircraft, the Model 11 Frigat, was exhibited at Moscow Salon in August 1995; remains available. Don was first shown in August 2001. On 3 March 2003, Unikomtranso JSC and Express Aircraft Company LLC of USA signed five-year agreement covering Russian manufacture of Express 2000, first five kits being due to arrive from USA in mid-2003. Unikomtranso to complete 90 aircraft as agricultural sprayers for use in Samara region. Two years later, nothing further had been heard and it was presumed that the venture had lapsed.

Don lightplane flown 2002 and reportedly entered production. By 2005 had produced D-401 (registration RA-1171K), which described as development of Don.

USTINOV

VALENTIN L USTINOV

Moscow

Between 1966 and 1973 Mr Ustinov was leader of a students' gyrocopter design and construction team at the Rizhsky Institut Inzenerov Grazhdanskoy Aviatsii (Riga Civil Aviation Engineering High School) in what is now Latvia, responsible for several programmes including the Riga-50 and -50M described in the 1971-72 *Jane's All the World's Aircraft*. The project ended when Mr Ustinov left to work in the Kamov bureau, but he has recently returned to the autogyro with a new design, the Adel'. The designer was assisted in the project by the TsAGI institute and Mil design bureau.

USTINOV ADEL'

TYPE: Single-seat autogyro.

PROGRAMME: First flight 15 August 2005. Public debut at Moscow Salon 16 to 21 August 2005.

DESIGN FEATURES: Agricultural sprayer with 120 litre (31.7 US gallon; 26.4 Imp gallon) chemical hopper ahead of raised cockpit with all-round transparencies. Payload 140 kg (309 lb), excluding pilot and fuel. SportCopter 9.14 m (30 ft) or, alternatively, Rotary Air Force rotor and three-blade tractor propeller; rotor prerotator; tailplane, twin tailfins and central underfin mounted on short, circular cross-section boom immediately to rear of cockpit; all fins have rudders.

STRUCTURE: Metal throughout; generally riveted aluminium alloy.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted, spring cantilever, tubular metal mainwheel legs with drag bracing arms and oleo-damped, levered suspension for wheels; spring/oleo suspension for steerable nosewheel.

POWER PLANT: One Subaru EJ-20 flat-four driving a three-blade tractor propeller.



Valentin Ustinov and his Adel' (Mr TwistAir)

1159198

ACCOMMODATION: Pilot only; forward-hinged door each side of cockpit. Accommodation heated.

EQUIPMENT: Spraying booms, with two rotary atomisers each side, mounted low on forward fuselage.

UUAP

ULAN-UDENSKY AVIATION JSC
(ULAN-UDE AVIATION PLANT JSC)

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TECHNICAL DIRECTOR: Sergey V Solomin
DEPUTY DIRECTOR-GENERAL, SALES AND MARKETING: Tsydyp Ts Galdanov
MANAGER, COMMERCIAL DEPARTMENT: Andrei Polyutin

Founded on 1 January 1939 as GAZ 99, the Ulan-Ude Aviation Plant formed on 26 October 2000 and was formally incorporated as such on 23 January 2001, having previously been known as Ulan-Ude Aviation Industrial Association. In 2005, 88 per cent of shares acquired by Oboronprom. It manufactures a wide range of items, from helicopters and aeroplanes to spares and domestic equipment. Is only Russian Federation plant currently producing both fixed- and rotary-wing aircraft. Employees in early 2006 totalled 6,200.
The factory has built I-16, Yak-3, Pe-2, La-5, La-7, La-9 and MiG-15 combat aircraft and, more recently, An-24 transports, Yak-25RV reconnaissance aircraft and MiG-27 fighter-

bombers, together totalling 8,000 aeroplanes. Helicopter production began in 1956, progressing through Ka-15, Ka-18 and Ka-25 to the 1970 launch of Mi-8 manufacture; total of 3,700 Mi-8 series built.
Current, or recent products include modern developments of the Mil Mi-8/Mi-17 series of helicopters and the Sukhoi Su-25UBK combat trainer and its related Su-39 attack aircraft. In 2001 revealed Mi-171 variant with rear loading ramp of own design, thus directly competing with Kazan's Mi-8MTV-5. Gained Far East order for five Mi-171sh (Mi-8AMTsh) combat helicopters in 2001 and sold 10 Mi-171s to Malaysia, work on first being under way by September 2004, although two Mi-171s delivered to Malaysian Interior Ministry in August 2004. Four Mi-171s to Pakistan, June 2002, with 12 more following by end of that year. Supplied four Mi-171s to Slovak Police. Three Mi-17V-5s to Iraq in 2005. Substantial Mi-17/171 orders received from China, including 24 to be delivered in 2006 from total 35 to be built in that year. Trained Czech pilots for Mi-17S variants being assembled in Czech Republic from kits, beginning 2005.
Will build Kamov Ka-62 and Ka-64; early 2006 estimate was for production launch in two or three years, achieving annual rate of 30 to 40 per year by 2010, assuming immediate launch funding of USD150 million. Oboronprom plans to return Su-25 and Su-39 to production in same timescale.
Also undertakes overhaul and upgrades, including five refurbished Mi-8AMTs supplied to Iranian Navy in 1999. Joint venture with SME Aviation of Malaysia, 1999, for promotion of Mi-8/Mi-17 and Su-25.

VASO

VORONEZHSKOYE AKTSIONERNOYE
SAMOLETOSTROITELNOYE OBSHCHESTVO OAO
(VORONEZH SHAREHOLDER AIRCRAFT-BUILDING SOCIETY JSC)

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GENERAL DIRECTOR: Vyacheslav A Silikov
CHIEF DESIGNER: Mikhail N Shushpanov
HEAD OF MARKETING AND SALES: V A Tulupov

VASO is an integral part of the Ilyushin Aviation Complex, responsible for production of the Ilyushin Il-96 transport aircraft; after almost ceasing due to lack of funding, manufacture was resumed in early 2003 to meet an Aeroflot order for eight. In July 2004, VASO directors authorised a follow-on batch of five Il-96s to meet possible future orders. Production in 2005 concerned two for Cubana, in VVIP configuration for Fidel Castro. Work proceeding on Aeroflot aircraft. Further plans, as yet unfunded, call for establishment of assembly line for Ilyushin Il-76, currently built in Uzbekistan. Transfer will produce an estimated 10,000 jobs, but programme seems unlikely to be supported in view of USD250 million cost.
VASO plans to form a joint holding with Ilyushin, initially by uniting the state shareholdings (30 per cent and 60 per cent, respectively) in each company; this will later be incorporated within AVPK Sukhoi as part of aviation industry restructuring plans. Russian government holding is 20 per cent. Future products could also include Ilyushin Il-112V.



Ilyushin Il-96 built by VASO in 2005 (Yefim Gordon) 1159211

Overhaul and modification activities have included conversion in 2003 of two Russian Air Forces Il-76MDs to -90 standard with PS-90A-76 turbofans.
Plant originated in GAZ 18, established 1932, building Tupolev TB-3 and DB-3. Original plant evacuated to Samara (then known as Kuybyshev) in 1941, forming basis of current Aviacor. Re-established at Voronezh in 1947 as GAZ 84; built Ilyushin Il-10, Il-28, Tupolev Tu-16, Antonov An-12 and Tu-128 heavy interceptor and Tu-144 supersonic airliner and Ilyushin Il-86 wide-bodied airliner. Until recently known as VAPO. Had plans to build Tupolev Tu-54 agricultural aircraft, but currently promoting rival Strizh ('Swift') designed by its own VASO-VGTU bureau (M-14 radial engine and 650 kg; 1,433 lb MTOW). Agreement of April 2004 covers production of An-148 empennage, flaps and engine pylons for Antonov. An-148 production licence obtained 25 November 2005; anticipates building 250 over following 10 years. Also produces boats, agricultural machinery, washing machines, food containers, motorcar silencers and other consumer items.

VITEK

KOMPANIYA VITEK
(VITEK COMPANY)

Renamed Istra.

YAKOVLEV

OPYTNO-KONSTRUKTORSKOYE BYURO IMENI A S YAKOVLEVA
OAO
(EXPERIMENTAL DESIGN BUREAU JSC NAMED FOR A S YAKOVLEV)

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DEPUTY GENERAL DIRECTORS:
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Roman P Taskaev (Flight Testing)
CHIEF DESIGNERS:
Konstantin F Popovich (Yak-130)
Aleksandr G Rakhimbaev (Yak-40, Yak-42)
Dmitry K Drach (Yak-52M, Yak-54, Yak-58, Yak-152, Yak-112)
Andrey I Matveev (MC-21)
Yuri I Yankevich (UAVs)
DEPARTMENTAL CHIEFS:
Anatoly S Ivanov (Marketing and Sales)
Evgeny M Tarasov (External Relations)
Yuri V Zasyupkin (Information/Press Service)

More than 200 aircraft designs and variants have been completed by Yakovlev since 1927, of which about 100, in 40 main types, have been manufactured in series. About 70,000 aircraft of Yakovlev design have been built, including 40,000 in Second World War and Chinese CJ-6s (version of Yak-18A).

In 2006, Yakovlev's most prominent activities comprised production and testing of Yak-130 combat trainer as selected by Russian Air Forces; design of future Yak-130 versions; testing of Yak-52M upgraded primary trainer for Russian Air Forces; design of Yak-152 new-generation primary trainer; design of MS-21 short/medium-range airliner; upgrading Yak-42D jet airliner; and production of Yak-54 aerobatic trainer.
Production of the Yak-58 lightplane is planned in Kazakhstan by the related Yak Alaon company; no recent progress. Yakovlev designers are working with HAIC of China on the JL-15 advanced trainer. Promotion continues of Yak-48 twin-jet regional aircraft programme in 4-, 5- and 6-tonne payload versions, although no known prospects of project being launched and funded.
In October 2003, Irkut and Yakovlev signed letter of intent on merger, former to purchase 75.5 per cent share of Yakovlev; the purchase was finalised on 29 May 2004 at a price of USD70 million. Yakovlev bureau's production facility moved in 2006 from central Moscow to join flight test centre at Zhukovsky.

YAKOVLEV Yak-130

TYPE: Advanced jet trainer/light attack jet.
PROGRAMME:

DEVELOPMENT MILESTONES

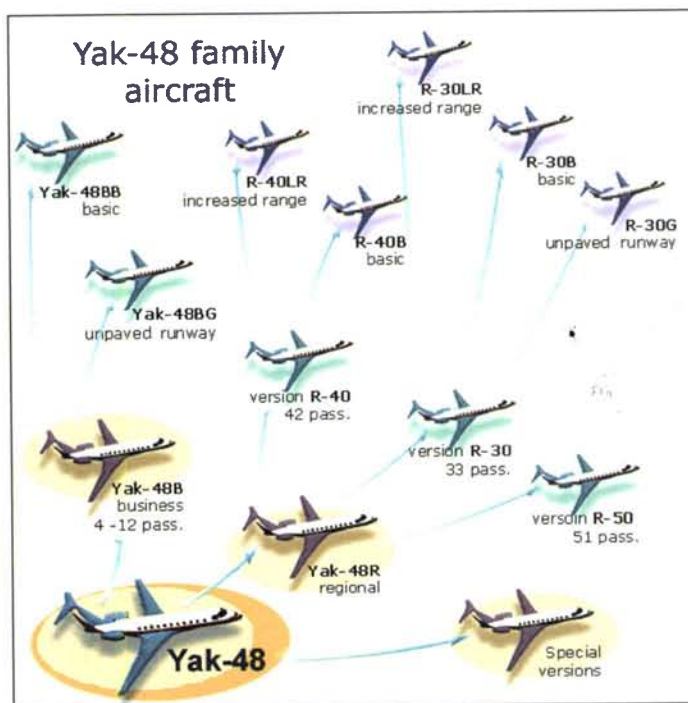
Design began	1991
Selected by Russian Air Forces	16 Mar 02
Official go-ahead	1995
First flight	25 Apr 96
Public debut	30 Nov 94
Production go-ahead	10 Apr 02
First flight, production	30 Apr 04

One of designs by five OKBs to meet official Russian requirement for 200 aircraft to replace Aero L-29 and L-39 Albatros for all aspects of flying training, basic to combat simulation, and combat; others included Sukhoi S-54, Myasishchev M-200 and MiG-AT. Known initially as Yak-UTS; work began in 1991; preliminary down-selection (with MiG-AT) in December 1991; design finalised by September 1993; construction of prototype began same



First pre-series Yakovlev Yak-130 (Yefim Gordon)

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Planned versions of Yak-48

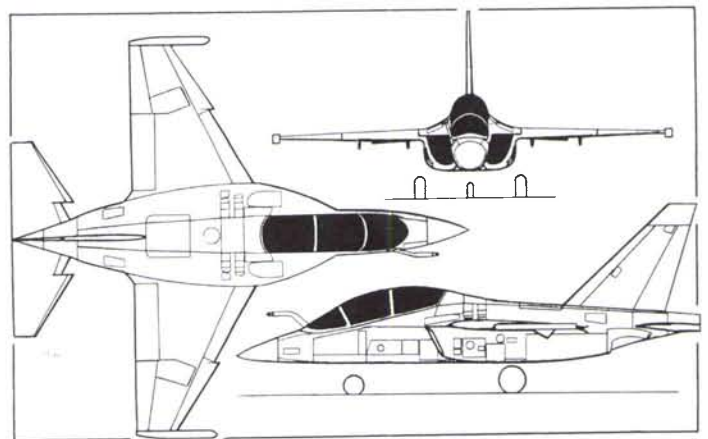
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month. In October Yakovlev had begun partnership with Aermacchi of Italy; joint definition completed in December 1999 resulting Yak/AEM-130 adopting two configurations: Yak-130 in Russia and M-346 Italian version.

Yak-130 announced as winner of Russian Air Forces' trainer competition on 10 April 2002 (decision having been reached on 16 March), in preference to MiG-AT. Yakovlev bureau funded 84 per cent of programme to this stage. Russian Air Forces' variant required for service from 2010 onwards. Aermacchi has rights to establish a second assembly line in Italy and contribute tail section and wing assemblies and FBW control system and avionics to both production lines, all components to be single-sourced. Yakovlev designed, and will manufacture, wing, tail surfaces, canopy, and digital FBW FCS and will integrate avionics and weapon systems on non-Russian Federation aircraft.

Yak-130D development aircraft shown to press 30 November 1994; first flight 25 April 1996 at Zhukovsky (later registered RA-43130). Public debut at Paris Air Show, June 2005. Flew 56 sorties (36 hours) in first year, including six without winglets, pending fitment of differently shaped units. Aircraft's equipment, including analogue flight control system, was adopted from Yak-141 V/STOL naval fighter, cancelled three years earlier. To Italy for flight trials July/August 1997, during which (18 July) the 100th sortie was flown; low-speed, high-AoA programme (30 flights) completed in Italy by prototype 31 January 1999; AoAs of up to 41° (maximum), 35° in stabilised flight and 20° in landing configuration were flown successfully. Aircraft returned to Russia for maintenance, followed by evaluation at Akhtubinsk and Armavir test centres; again in Italy by 2000. Total 305 sorties and 254 hours flown by mid-2001; 350 sorties by mid-2002; painted in tactical camouflage for display at MAKS, Moscow, August 2001. Flown 485 sorties up to February 2003. Withdrawn from use by January 2005.

Ten planned preseries aircraft, slightly smaller than prototype, were to comprise three for Zhukovsky test centre for evaluation originally planned to begin in 1998 and seven for air force evaluation planned for 1999 although development programme transferred to Italy, mid-1998, to escape financial instability in Russia, leading to far-reaching reappraisal. By September 1999 it was expected that funding for four preproduction prototypes would soon be obtained, together with three aircraft for evaluation; contract for initial four Yak-130-01s (including two — reduced in 2005 to one, the second airframe — for static tests) signed February 2001 between Yakovlev and Sokol production plant, all to be built in 2003-04; initial aircraft ('01') rolled out at Sokol plant on 30 May 2003; exhibited, unflown, at Paris



Production version of Yakovlev Yak-130 advanced trainer/combat aircraft (Paul Jackson)

1158784

in June 2003; first flight targeted for November 2003, with certification testing to be complete by end of 2004, but maiden flight not accomplished until 30 April 2004 (with AI-222-25 engines); conducted early vibration tests; by mid-2006 was engaged in flight-structural, performance and flutter testing. Static test airframe delivered by Sokol to Yakovlev Design Bureau in January 2004. Second production ('02') aircraft flew 5 April 2005; engine trials at Akhtubinsk test centre, 2006; third was due to have been completed in October 2005 for use as avionics and armament testbed; initial flight 27 March 2006, with all three Yak-130s operating from Zhukovsky test airfield, Moscow, by mid-2006, although No. 3 lost in accident on 26 July 2006. Static test airframe delivered to Yakovlev in January 2004. This had completed trials by December 2005. In August 2006, Yakovlev announced intention to re-equip one of two surviving military trials aircraft as light attack trainer following its return from Akhtubinsk; this to be private venture requiring USD10 million investment. First prototype was to receive RD-2500 engines in third quarter of 2001, while 10 interim AI-222 engines were due to be delivered in 2002 from Motor-Sich for use in pre-series aircraft. However, only first two AI-222s had been received from Ukraine by early 2003 for static trials; first two flyable engines arriving December 2003.

Announced 20 June 2003 that Russian President had approved manufacture of 200 Yak-130s; first 12 ordered for delivery in 2006-07; later extended to 2007-09.

Navalised version proposed for carrier training; tender now includes Penza (Russia)/CAE Electronics (Canada) simulators and Yak-152 for screening and primary training.

Confirmed June 2006 that Irkut plant to assemble export Yak-130s, although with some components from home production plant, Sokol.

CURRENT VERSIONS: **Yak-130D**: Development prototype RA-43130.

Yak-130UBS: For Russian air force; indigenous equipment; service entry originally scheduled for 2000.

Yak/AEM-130: Hybrid export version; also known as AY-130; programme frozen. Items listed under Systems and Avionics refer mainly to this version. Viewed as low flyaway cost solution to Western trainer requirements by using Yak's good aerodynamic configuration and by addressing poor man-machine interface, low thrust-to-weight ratio and some other "problem areas".

Yak-133: Single-seat light attack version with additional fuel in lieu of rear cockpit (1,050 litres; 277 US gallons; 231 Imp gallons); radius of action up to 594 n miles (1,100 km; 684 miles) with 1,500 kg (3,307 lb) weapon load; 27.5 kN (6,173 lb st) AI-222-28 engines. Design study only.

Yak-133IB: Fighter-bomber (*Istrebitel-Bombardirovshchik*) with nose radar, possibly *Leninets Kinzhal*.

Yak-133R: Reconnaissance (*Razvedchik*) version.

Yak-133PP: Electronic warfare (*Postanovshchik Pomekh*) version. Nose radar and underwing jamming pods.

Aermacchi M-346: Under development in Italy. Marketing agreement assigns NATO to Aermacchi and CIS to Yakovlev; rivals will compete in remaining markets.

CUSTOMERS: One demonstrator; three flying preseries; plus initial batch of 12 being delivered in 2007-09 for evaluation at Krasnodar Military Aviation Institute and, initially by Lipetsk test centre. Interest expressed by Slovak Republic, which received demonstration in July

1997; Slovakia announced on 5 August 1998 that debts owed by Russia will be repaid in part by delivery of 12 Yak-130s, although no firm contract yet placed. The Yak-130 remains a competitor in Slovakia's search for a subsonic multirole fighter with the AMX, L 159, Hawk and MiG-AT, but has not been officially selected. Its Slovak engines give it competitive advantage. Algerian interest was reported in early 2002, leading to requirement for 16 by 2005; in July 2006 this stated by Sokol to be an 'order' requiring deliveries to begin in 2007. Indian prospects for licensed production raised in January 2003; Mexican interest also in 2003. By mid-2006 Ghana, Libya, Syria and Venezuela identified as sales prospects. Export sales anticipated of up to 630, plus 120 to 140 for Russian Federation.

COSTS: USD12 million to USD15 million, depending on standard (2002). USD70 million reportedly already spent by Aeromacchi and USD30 million by Yakovlev, with another USD100 million of R&D spending to follow.

DESIGN FEATURES: Designed from outset to conform to Western specifications for structure, flight controls and maintenance (MSG-3 and MIL-STD-470B). All-swept mid-wing monoplane, except for straight wing and tailplane trailing-edges; no dihedral or anhedral; two-piece full-span automatic leading-edge slats originally on prototype, but dogtooth leading-edge discontinuity tested on RA-43130 and adopted on production version; all-moving low-mounted tailplane, with dogtooth leading-edge; forward-hinged, door-type airbrake on spine, ahead of fin; engines in ducts under wingroots, beneath LERX extending almost to windscreen; optional air intake screens obviate ingestion damage when operating from unpaved airstrips. Wing leading-edge sweepback 31°. Prototype's winglets reduced in size and moved inboard to wingroot as 'LEX fence'; may be deleted in production version. Strakes ahead of windscreen by 1999 replicate characteristics of planned rounded nose. Series production versions will be 1 tonne lighter than the prototype with a more slender, shallower fuselage, lacking chines.

Service life 10,000 hours; extension planned to 15,000 hours, or 30 years.

FLYING CONTROLS: Avionika full-authority, analogue, four-channel fly-by-wire system, with digital 'fourth channel' and 'carefree handling', slaved to laser-gyro platform, developed from that of Yak-141 V/STOL combat aircraft. Demonstrator has two selectable FCS models, one simple, one in MiG-29 class; will be replaced by digital system developed by BAE Italy and Lear Astronics. Prototype inherently stable; production aircraft intended to have 5 per cent longitudinal instability to reproduce handling characteristics of MiG-29/Su-27 series. Handling characteristics can be reprogrammed to simulate other types. Max AoA 42°.

STRUCTURE: Mainly of light alloys, but carbon fibre composites for most control surfaces. Structural design accords to MIL-STD-1530A and MIL-A-8660A.

Fuselage built in three sections: nose (back to frame 15); centre-section (frames 15 to 28); and empennage (from frame 28). Separate wing panels built on five spars, of which three attached to fuselage. Three-spar fin and riveted rudder assembly with dielectric fin tip.

Combat version has Kevlar armour around power plant, cockpits and avionics compartment aft of cockpits.

LANDING GEAR: Retractable tricycle type; single wheel on each unit; mainwheels retract into engine ducts; low-pressure tyres suitable for unpaved airfields with ground bearing ratio in excess of 6 kg/cm² (85 lb/sq in). Nosewheel steering to MIL-STD-8812 Class A. Anti-skid system.

POWER PLANT: Prototype fitted with two Povolzské Strojárne ZMK DV-2S (Klimov RD-35) turbofans each 21.58 kN (4,852 lb st). Autonomous engine starting; 20 second negative g fuel supply.

Production version of DV-2, designated ZMKB Progress AI-222-25, selected by Russian Air Forces and built in Russia by MMPP Salut and with indigenous FADEC. Rating 24.5 kN (5,512 lb st).

Two fuel tanks in wings; two in fuselage; combined capacity approximately 2,240 litres (592 US gallons; 493 Imp gallons) but normal training fuel restricted to approximately 1,060 litres (280 US gallons; 233 Imp gallons). Provision for two external fuel tanks, each of 560 litres (148 US gallons; 123 Imp gallons) beneath wings. Single-point pressure refuelling; gravity filling optional. Detachable aerial refuelling probe. Prototype has intake FOD doors of MiG-29 type which will be option for production version.

ACCOMMODATION: Two crew in tandem under blister canopy, on Zvezda K-36LT3.5Ka zero/zero ejection seats with built-in computer, side-force rocket engine and extreme attitude performance. KSAP-130 emergency equipment suite for ejection sequence management; export option of Martin-Baker Mk 16 standard on M-346; explosive cord canopy penetration; rear seat raised. Accommodation air conditioned and pressurised up to differential of 0.26 bar (3.8 lb/sq in). Front pilot has maximum view over nose of -16°; rear pilot -6°.

SYSTEMS: Flight control system is quadruplex, redundant, digital, with full authority, designed by MIEA (Moscow Institute of Electromechanics and Automatics); provides artificial stability, flying qualities in accordance with MIL-STD-1797A, controllability up to at least 35° AoA, carefree handling (g limitation, stall/spin prevention, AoA limitation) and adaptability to various weapon configurations and degrees of automation and autopilot modes; includes automatic reversionary modes in the event of damage or failure; and built-in test capability. Aerosila TA-14-130 APU, providing normal and emergency electric, hydraulic and pneumatic power on ground and in air. Zvezda OBOGS (Russian: BKDU). Dual independent hydraulic systems, pressure 207 bar (3,000 lb/sq in); single failure leaves 75 per cent control surface movement; separate accumulators for emergency landing gear extension and brake. Pneumatic system for pressurisation of hydraulic tanks of booster and common systems; emergency opening of landing gear doors; and emergency gear lowering. Dual Rubin 20 kVA generators (one per engine); system rating 200/115 V AC, 400 Hz. Two Ni/Cd batteries. Anti-icing system for windscreen and engine inlet guide vanes. Fire suppression system for engine and APU.

AVIONICS: Western avionics optional to replace standard Russian equipment from Elektroavtomatika.

Comms: Dual V/UHF transceivers; intercom; IFF; ATC transponder.

Radar: Optional. Kopyo and Osa under consideration.

Flight: Elektroavtomatika navigation computer; laser gyro INS with embedded GPS by MIEA; air data system, short-range radio nav Tacan and VOR/ILS by VNIIRA-Navigator; ADF and radio altimeter; IFF. Flight data recorder by Polyot.

Instrumentation: HUD in front cockpit as part of collimated flight and sighting display in conjunction with pilot's helmet-mounted target designator; two Elektroavtomatika square colour multifunction liquid-crystal displays in each cockpit (three 152 × 203 mm; 6 × 8 in MFDs in export aircraft) with standby electromechanical flight/nav instruments. NVG compatibility; optional HOTAS controls.

Mission: Optional laser/TV weapon guidance system; Platan and Sapsan under consideration. Mission data entry system; optical weapon aiming computer and weapons control system; simulator of moving targets, guidance commands, weapons preparation and tactical situations; flight data and crew actions recorder; TV monitor of eye and hand positions, with video recorder, in front cockpit.

Self-defence: Provision for chaff/flare dispenser, RWR and active electronic countermeasures.

ARMAMENT (optional): Nine (including wingtip AAM stations) hardpoints (including four under each wing) for up to 3,000 kg (6,614 lb) of rockets, guns, missiles, guided and

unguided bombs, including eight 250 kg bombs, four 500 kg laser-guided bombs, submunitions containers, Kh-25ML (AS-10 'Karen') or AGM-65 Maverick ASMs, R-73 (AA-11 'Archer'), AIM-9L Sidewinder or Magic 2 AAMs.

DIMENSIONS, EXTERNAL (production aircraft):

Wing span	9.86 m (32 ft 4 1/4 in)
Wing aspect ratio	4.0
Length overall	11.495 m (37 ft 8 1/2 in)
Height overall	4.76 m (15 ft 7 1/2 in)
Wheel track	2.53 m (8 ft 3 1/2 in)
Wheelbase	3.90 m (12 ft 9 1/2 in)

AREAS:

Wings, gross	23.52 m ² (253.2 sq ft)
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WEIGHTS AND LOADINGS (production aircraft):

Weight empty	4,600 kg (10,141 lb)
Max weapon load	3,000 kg (6,614 lb)
Fuel weight: normal training	850 kg (1,874 lb)
max internal	1,750 kg (3,858 lb)
with two external tanks	2,700 kg (5,952 lb)
T-O weight: trainer, typical	5,700 kg (12,566 lb)
attack, normal	8,090 kg (17,835 lb)
attack, max	9,000 kg (19,841 lb)
Max wing loading: trainer	242.3 kg/m ² (49.64 lb/sq ft)
attack/trainer	382.7 kg/m ² (78.37 lb/sq ft)
Max power loading: trainer	116 kg/kN (1.14 lb/lb st)
attack/trainer	184 kg/kN (1.80 lb/lb st)

PERFORMANCE (clean, estimated):

Max level speed	572 kt (1,060 km/h; 659 mph)
Unstick speed	108 kt (200 km/h; 124 mph)
Landing speed	103 kt (190 km/h; 118 mph)
Stalling speed, 20% fuel	89 kt (165 km/h; 103 mph) CAS
Max rate of climb at S/L	4,500 m (14,763 ft)/min
Service ceiling	12,500 m (41,020 ft)
T-O run	340 m (1,115 ft)
Landing run	550 m (1,805 ft)
Radius of action, 5 min combat: interdiction, two Mk 83; 1,000 lb bombs, two AAMs, gun pod, two external tanks, hi-lo-hi	460 n miles (852 km; 529 miles)
close air support, four 500 kg bombs, two AAMs, gun pod, hi-lo-hi	234 n miles (435 km; 270 miles)
Range: with max internal fuel	1,079 n miles (2,000 km; 1,242 miles)
with two external tanks	1,800 n miles (3,333 km; 2,071 miles)
Max rate of roll	200°/s
Sustained g limit at M0.8 at 4,575 m (15,000 ft) with 50% internal fuel	+5.4
g limits	+8/-3

YAKOVLEV Yak-3M and Yak-9U-M

TYPE: Aerobatic single-seat sportplane; aerobatic two-seat sportplane.

PROGRAMME: Reproduction Second World War fighter. Prototype of original wooden-skinned Yak-3 flew 1943; all-metal version flew 1945; deliveries to Soviet air forces began July 1944, totalled 4,848 (of 36,737 Yakovlev single-engined Second World War fighters); described often as lightest weight and most agile monoplane of 1939-45 period; able to turn 360° in 18.5 seconds, all-metal version now available, with Western power plant and uprated instrumentation; new-build 'prototype' (0470101, later N854DP) displayed 1993 Paris Air Show; 11 built by Strela at Orenburg to meet orders from Gunnell Museum, USA; one later to New Zealand (then Australia in 1999); and one to South Africa (then USA in 2005); one to Germany in 2004.

Production turned in 1996 to Yak-9U of similar appearance. Original Yak-9 entered service in 1942 (before Yak-3) and 16,769 were built. Total of eight all-metal Yak-9U-M replicas exported to USA by mid-1999, of which five then flying; one subsequently to France; distribution by Shadetree Aviation of Carson City, Nevada (Tel: +1 775 841 10 68; Web: www.shadetreeusa.com). Ninth Yak-9 completed by Strela in late 2001 for export to US, being registered in June 2003, but to Australia in 2004.

In all, 21 reproductions built by 2002, according to Yakovlev information, apparently including one untraced Yak-7.

UK importer, Richard Goode Aerobatics, commissioned four further Yak-9s for delivery in 2002, three having already been sold by May 2002. None of these had appeared by late 2005, however.

In August 2005, a Yak-3U/R-200 was registered in US (as N46463), apparently as a new-built aircraft produced by Avioane in Romania.

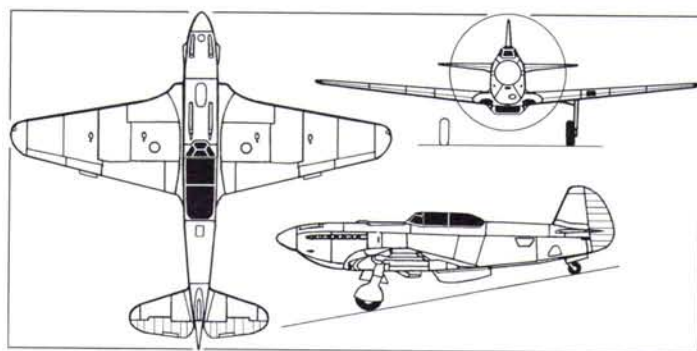
Note that further Yak-3UAs have been produced by other sources through conversion of Yak-11s, mostly with Pratt & Whitney R-1830/R-2000 Twin Wasp radial engines.

COSTS: US\$385,000 plus tax (2004).

Following data apply to Yak-9.

DESIGN FEATURES: Precise reproduction in metal of Second World War airframe, except for repositioned carburettor air intake above engine cowling to suit changed engine. Conventional cantilever low-wing configuration, with tapered, round-tipped wings. Mainwheel tyres size 600×180.

POWER PLANT: Reconditioned 925 kW (1,240 hp) Allison V-1710-39 12-cylinder V liquid-cooled piston engine; three-blade propeller. Fuel capacity 526 litres (139 US gallons; 116 Imp gallons).



Yakovlev Yak-9U reproduction (Paul Jackson)



First Yak-3M from recent production flying with blown canopy in 2005 (Paul Jackson)

1151686

DIMENSIONS, EXTERNAL:	
Wing span	9.20 m (30 ft 2¼ in)
Wing aspect ratio	5.7
Length overall	8.55 m (28 ft 0½ in)
Height overall	2.39 m (7 ft 10 in)
AREAS:	
Wings, gross	14.85 m² (159.8 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	2,135 kg (4,707 lb)
Max T-O weight	2,600 kg (5,732 lb)
Stalling speed: clean	103 kt (191 km/h; 119 mph)
landing configuration	81 kt (150 km/h; 94 mph)
Max wing loading	175.1 kg/m² (35.86 lb/sq ft)
PERFORMANCE:	
Max level speed	377 kt (698 km/h; 434 mph)
Max power loading	2.81 kg/kW (4.62 lb/hp)

YAKOVLEV Yak-54

TYPE: Aerobatic two-seat sportplane.
PROGRAMME: Yak-54 announced, and construction began, 1992; prototype at 1993 Paris Air Show; first flown 23 December 1993; third prototype at Paris in 1995; production from 1995 at Saratov Aviation Plant (SAZ), with maximum capacity of more than 100 per year. Competed successfully in World and European advanced aerobatics competitions. However, production suspended in 1998; to resume after certification received, early 2002; initial batch of five funded (and to be marketed) by ZAO Gorki Yuzhnyy, including two for Promety (Prometheus) aerobatic group (representing total 2003 production) and one for export to Australia; a Slovakian customer has also been mentioned. However, in February 2002, SAZ again suspended production, having built only one aircraft (in 2001); this received Russian certification on 22 November 2002, following improvements to aerodynamics aimed at enhancing basic handling qualities and aerobatic capability. Arsenyev plant announced in January 2006 that batch of 10 Yak-54s under construction, with first deliveries due by end of that year.

CURRENT VERSIONS: **Yak-54:** As described.
Yak-56: Primary trainer derivative; also designated **Yak-54M:** red, 294 kW (394 hp) M-14PF, retractable tricycle landing gear and SKS-94 crew ejection seats. Prototype under construction in 1999. Wing span 8.80 m (28 ft 10½ in); length 7.30 m (23 ft 11½ in); height overall 2.80 m (9 ft 2¼ in); empty weight 950 kg (2,095 lb); fuel weight 200 kg (441 lb); maximum take-off weight 1,300 kg (2,866 lb); maximum stalling speed 54 kt (375 km/h; 233 mph) manoeuvring speed 243 kt (450 km/h; 280 mph) speed limits +9/-7 (100 km/h; 63 mph); maximum range 540 n miles (1,000 km; 621 n miles).
In October 2001, Yak-152 was unsuccessful in competition against military trainer to provide new equipment for ROSTO (successor to DOSAAF); to enter production organisation. Despite this, prototype intended to fly in 2003 and typified in April 2003 at Saratov (SAZ). Commitment reconfirmed by Yakovlev's chairman, 22-9-10-2002, but engine reverted to 265 kW (355 hp) M-14Kh and MTOW 1,321 kg (2,910 lb). Project apparently delayed or abandoned although Chinese interest was reported in September 2006.

Yak-57: Single-seat sportplane; under development by 1999.
CUSTOMERS: Total 48 Yak-54s ordered in January 1997 by Northwest Aerobatic Center, Ephrata, Washington, USA, and Dancing Bear air show team. 15 built up to 1998 suspension of production; five (of six exported) flying in USA, plus one (second-hand)

delivered to Australia during 1999. In March 2002, Yak-54 fleet stated to be four in Russia, five in US, plus two destroyed in accidents. US marketing by Yakovlev Aircraft USA, Scotts Mills, Oregon; e-mail: info@yak54.com. Kaiser Flugzeugbau of Germany planned acquisition of evaluation Yak-54 in 2004 with a view to becoming a distributor.

Following resumption of manufacture, Saratov delivered three Yak-54s to Central Aeroclub of Samara by December 2003, and produced further three in 2004, reportedly for Russian ROSTO training organisation. By early 2005, additional 10 on order.
COSTS: USD175,000 to USD190,000 (2006).

DESIGN FEATURES: Optimised for aerobatics; derived from Yak-55M. Conventional mid-wing configuration; symmetrical section; no dihedral, anhedral or incidence; almost full-span ailerons, elevators and rudder all horn-balanced; each aileron has large suspended balance tab. Designed on basis of systems and units of Yak-55M.

FLYING CONTROLS: Conventional and manual. Ailerons occupy 90 per cent of wing trailing-edge and have both horn balance and suspended tab; horn-balanced tail surfaces.

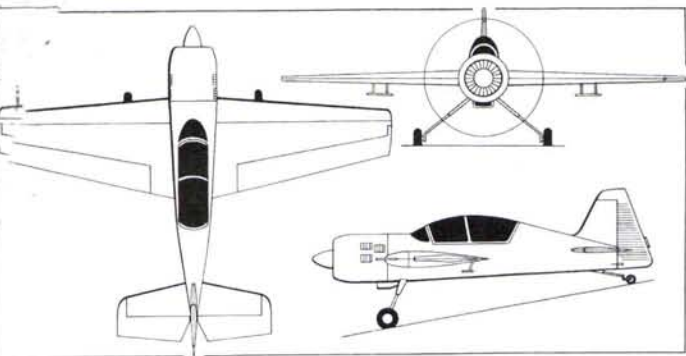
STRUCTURE: All-metal; two-spar wings; semi-monocoque fuselage; conventional tail unit.

LANDING GEAR: Tailwheel type; fixed. Fuselage-mounted titanium spring cantilever mainwheel legs and small wheels, tyre size 400x150; tailwheel tyre size 200x80.

POWER PLANT: One 265 kW (355 hp) VOKBM M-14P nine-cylinder air-cooled radial engine; MTV-9-B-C/CL-250-27 three-blade variable-pitch propeller.

ACCOMMODATION: Two seats in tandem under continuous transparent canopy, hinged to starboard.

DIMENSIONS, EXTERNAL:	
Wing span	8.16 m (26 ft 9¼ in)
Wing aspect ratio	5.2
Length overall	6.91 m (22 ft 8 in)



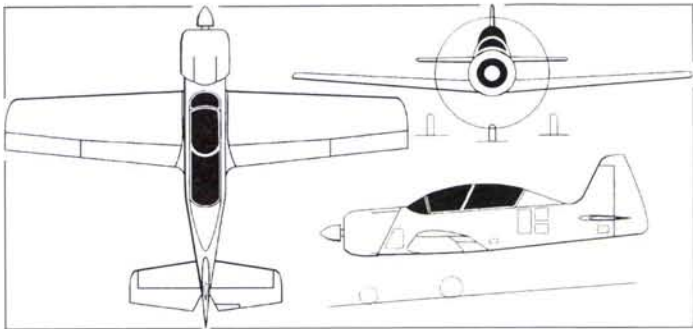
Yak-54 sporting and aerobatic training aircraft (Mike Keep)

1162417



Yakovlev Yak-54 of Patrouille Tranchant team (Paul Jackson)

1162405



Provisional general arrangement of Yakovlev Yak-152 (Paul Jackson)

1158758

AREAS:	
Wings, gross	12.89 m ² (138.75 sq ft)
WEIGHTS AND LOADINGS:	
Max T-O weight: Aerobatic	
one pilot	901 kg (1,986 lb)
two occupants	990 kg (2,182 lb)
Max Aerobatic wing loading	76.8 kg/m ² (15.73 lb/sq ft)
Max Aerobatic power loading	3.74 kg/kW (6.15 lb/hp)
PERFORMANCE:	
Never-exceed speed (VNE)	224 kt (415 km/h; 257 mph)
Stalling speed	60 kt (110 km/h; 69 mph)
Rate of roll	360°/s
Max rate of climb at S/L	900 m (2,950 ft)/min
Max certified altitude	3,000 m (9,840 ft)
Ferry range	377 n miles (700 km; 435 miles)
g limits	+9/-7

YAKOVLEV/ILYUSHIN MS-21

TYPE: Regional jet airliner.

PROGRAMME: Originated in Yak-242, which proposed as successor to Yak-42 and included in State Programme for Aviation, with maiden flight scheduled for 1998. Project lapsed, but revived in 2003 when re-launched as MS-21 (*Magistral'nyi Samolet 21 Veka*: airliner of the 21st Century), with design inputs from Ilyushin, having gained official support against Il-214 and Irkut 111 in competition decided on 21 July and formally announced 18 August 2003. Also envisaged as Tu-154M replacement.

Ilyushin expected to become lead partner on MS-21 and sign development contract with Rosaviakosmos; Yakovlev then to become subcontractor to Ilyushin. However, in December 2004, Ilyushin confirmed Yakovlev as lead developer. Tupolev signed participation agreement in mid-2005 covering joint development. Preliminary design target was mid-2006; critical design review due by end of 2008. Chief designer, Andrey Matveyev. Irkut to join programme as risk-sharing partner. First flight two years from go-ahead and service entry three years thereafter. Production will be by Aviastar.

CURRENT VERSIONS: **MS-21-100**: Shrunk version; 132 seats in all-economy layout.

MS-21-200: Baseline version. 150 seats in all-economy layout.

MS-21-300: Stretched version. 168 seats in all-economy layout.

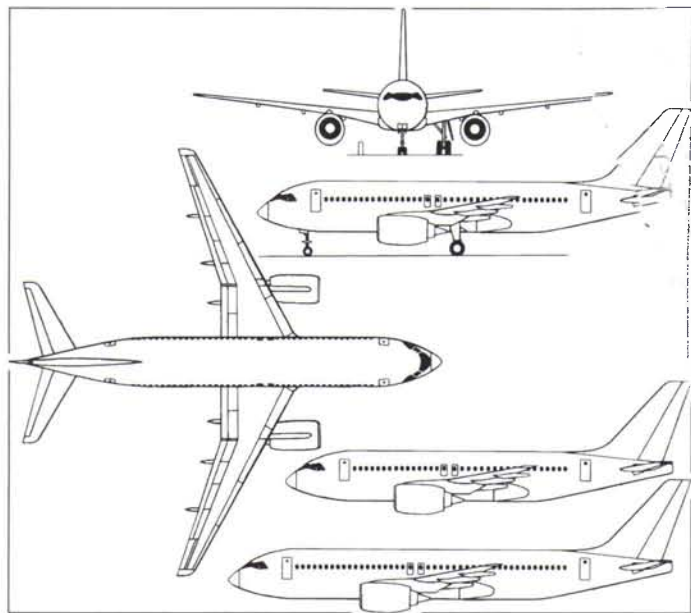
MS-21LR: Long-range version of all three fuselage lengths: **-100LR**, **-200LR** and **-300LR**.

MS-21K: Freighter; 17 t payload.

MS-21KP: Combi; cargo compartment length 21.43 m (70 ft 3 3/4 in).

CUSTOMERS: Predicted market for 600 MS-21s over 20 years, including 400 for Russian operators.

COSTS: Development estimated as USD460 million (2003), including USD200 million from Russian government. Revised in 2005 to USD1 billion. Unit cost target for MS-21-200 USD35 million (2005).



Yakovlev MS-21-200 regional airliner, with additional profiles of -100 (centre) and -300 (bottom) (Paul Jackson)

1159129



Model of Yakovlev MS-21 as envisaged in 2006, without winglets (Paul Jackson)

1159172

DESIGN FEATURES: Low-wing airliner with two podded engines underwing. Cruising speed in excess of M0.8; significant use of composites materials. To conform to equivalents of FAR Pt 25 for airframe; Pt 33 engines; Pt 34 emissions; and Pt 36/ICAO Chapter 4 noise. Intended 70 per cent engine, systems and avionics commonality with Ilyushin/Irkut/HAL Il-214. Design aims include improvements over Airbus A320 of 15 per cent structural weight efficiency, 20 per cent direct operating cost and 15 per cent fuel consumption. Service life 60,000 hours and 30,000 landings over 25 years.

Supercritical wing section designed in collaboration with TsAGI; leading-edge sweepback 25°; winglets on early impressions had been deleted by 2006.

FLYING CONTROLS: Digital fly-by-wire controls. Double-slotted flaps, four-section leading-edge slats and five-section spoilers per wing.

STRUCTURE: Combination of updated and new aluminium alloys with composites (including Airbus-developed GLARE). At time of service entry, composites to comprise 30 per cent by weight. Wing envisaged initially of conventional alloy structure, replaced in post-2015 production by all-composites structure, increasing composites fraction to 40 or 45 per cent.

LANDING GEAR: Tricycle type; hydraulically retractable. Two-wheel main bogies; tyre size 1200x410. Twin nosewheel, size 660x200. Option of four-wheel main bogies with 950x300 tyres.

POWER PLANT: Two turbofans in 108 to 117 kN (24,200 to 26,400 lb) class, such as 118 kN (26,450 lb st) Aviadvigatel PS-12 turbofans (derated PS-90A), Progress/Motor Sich/Salyut D-436TX or Western CFM56-5A1, -5B4, -7B26, or IAE V2500A/V2527-A5.

ACCOMMODATION: Two flight deck crew. Seating for 132 to 168 passengers three abreast at 81 cm (32 in) pitch with 55 cm (21 1/2 in) aisle. Overhead bins with 0.06 m³ (2.1 cu ft) per passenger. Two underfloor freight holds for total of six LD3-46W containers. Passenger doors, port, front and rear; service doors, starboard, front and rear; two emergency exits overwing, each side. Combi and freighter versions with cargo door ahead of wing, port side; accommodates eight P1, P2 or P6 pallets.

AVIONICS: Instrumentation: 'Glass cockpit' with 203 x 305 mm (8 x 12 in) LCDs with Dassault EASYs interface.

All data are provisional.

DIMENSIONS, EXTERNAL:

Wing span	34.80 m (114 ft 2 in)
Wing aspect ratio	10.5
Length overall: 100	34.00 m (111 ft 6 1/2 in)
200	37.03 m (121 ft 5 3/4 in)
300	39.50 m (129 ft 7 in)
Max diameter fuselage	4.09 m (13 ft 5 in)
Freight door (starboard, port, front):	
Width	2.90 m (9 ft 6 1/4 in)
Height	2.10 m (6 ft 10 3/4 in)

AREAS:

Wings, gross	115.0 m ² (1,237.8 sq ft)
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WEIGHTS AND LOADINGS:

Operating weight empty, equipped: 100	37,500 kg (82,673 lb)
200	38,500 kg (84,878 lb)
300	39,600 kg (87,303 lb)
Max payload: 100	12,500 kg (27,558 lb)
200	14,300 kg (31,526 lb)
300	16,000 kg (35,274 lb)
Max fuel weight	21,000 kg (46,297 lb)
Max T-O weight: 100	66,000 kg (145,505 lb)
200, 300	70,500 kg (155,425 lb)

PERFORMANCE:

Cruising speed	459 kt (850 km/h; 528 mph)
Balanced field length: 100LR, 200LR, 300LR	2,300 m (7,545 ft)
100LR, 200LR	2,500 m (8,205 ft)
200LR, 300LR	2,600 m (8,530 ft)
Range: 100LR	2,159 n miles (4,000 km; 2,485 miles)
100	3,239 n miles (6,000 km; 3,728 miles)
200	2,429 n miles (4,500 km; 2,796 miles)
200LR	2,969 n miles (5,500 km; 3,417 miles)
300	1,889 n miles (3,500 km; 2,174 miles)
300LR	2,321 n miles (4,300 km; 2,671 miles)

Serbia

STORCH

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Web: www.slepcevstorch.com

MANAGING DIRECTOR: Nestor Slepcev

Nestor Slepcev designed, built and flew two earlier aircraft before producing the Storch Mk 4. In August 1996, Mr Slepcev landed a Storch Mk 4 on Gran Sasso, Italy, in re-enactment of the rescue of Benito Mussolini, 53 years earlier. Previously based in Australia, Storch Aviation had moved to Serbia by 2005.

STORCH STORCH SS Mk 4

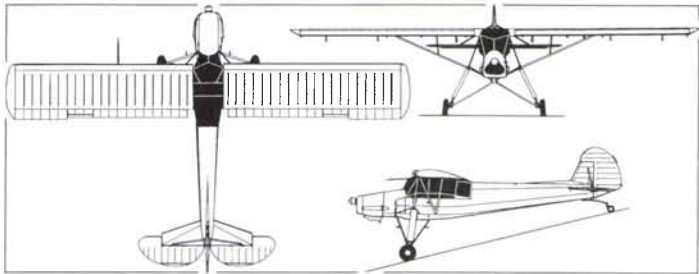
TYPE: Tandem-seat ultralight/kitbuilt.

PROGRAMME: Engineering structure designed by Bill Whitney. First flight (VH-ZOR) 1991, then with single seat and powered by 59.6 kW (79.9 hp) Rotax 912 engine; two-seat version first flown 1994; JAR-VLA certification achieved in Australia, 14 October 1999 and in Spain on 21 May 2001.

CURRENT VERSIONS: **Storch 'Ultra'**: Ultralight; Australian Primary Category; CAO 19 (amateur build).

Storch 'Muster': Utility version; envisaged uses include cattle mustering, Australian CAO 24 or certified categories.

Storch 'Criquet': Powered by Rotec Fireball 7 seven-cylinder radial engine of 82.0 kW (110 hp), thus resembling Morane-Saulnier MS 502 Criquet. Prototype VH-AJH public debut at Avalon Air Show, February 2001.



Storch SS Mk 4 (Paul Jackson) 1158038

Super Storch Mk 4: Higher-powered version, usually with 119 kW (160 hp) Textron Lycoming O-320 engine, top speed of 110 kt (203 km/h; 126 mph) and empty weight of 470 kg (1,036 lb) and MTOW 861 kg (1,900 lb). 13 in Australia by April 2002. At least one (N2898J) in USA with Superior (Textron Lycoming) O-360 of 149 kW (200 hp); empty weight 554 kg (1,222 lb); MTOW 750 kg (1,653 lb).

Storch SS-FP: Floatplane; prototype, with full Lotus floats and Rotax 912S2 engine, registered VH-ANB in November 2001.

Storch Moose: M-14P radial engine (265 kW; 355 hp) installed in prototype VH-AYQ (100th Storch), which registered in November 2001. Fuel capacity 400 litres (106 US gallons; 88.0 Imp gallons). Length 7.62 m (25 ft 0 in); wing span 10.67 m (35 ft 0 in); empty weight 798 kg (1,760 lb), MTOW 1,397 kg (3,080 lb); max speed 105 kt (194 km/h; 120 mph); take-off run 61 m (200 ft).

CUSTOMERS: More than 140 sold by early 2006 (including some 50 factory-built) to customers in 21 countries in Africa, Australasia, Europe, North America and Pacific Rim. Highest known completion is No. 105, registered in 2003 and owned by Mr Slepcev. One known in 2004. Approximately 60 per cent of production is factory-built.

COSTS: USD58,000, factory-complete (2000).

DESIGN FEATURES: Three-quarters scale version of Second World War German Fieseler Fi 156 Storch STOL liaison and observation aircraft. Wings are removable for transport or storage. Quoted build time for kitbuilt version approximately 600 hours. Aerofoil derived from Clark Y.

FLYING CONTROLS: Conventional and manual. Actuation by pushrods and cables; ground-adjustable tab on each aileron. Fowler flaps and full span leading-edge slats. Horn-balanced tail surfaces. Electronic flight-adjustable tailplane incidence for pitch trim in Ultralight; VLA has fixed tailplane with trim tab in port elevator.

STRUCTURE: Welded 4130 chromoly steel tube fabric-covered fuselage and tail surfaces; metal engine cowling. Strut-braced 6061-T6 aluminium wings with stamped ribs and D-section leading-edge; latest versions aluminium-covered, except fabric flaps and ailerons. Composites wheel fairings.

LANDING GEAR: Tailwheel type; fixed. Centreline hinged, streamlined tube Vs attached to telescoping, bungee cord-sprung struts, upper ends of which fixed to apexes of tube pyramids on fuselage sides. Mainwheel size 8.00x6-6; Maule tailwheel, diameter 15 cm (6 in); hydraulic disc brakes. Float installation optional.



Storch SS Mk 4 built in UK and finished in Second World War markings (Paul Jackson) 1037941

POWER PLANT: Standard factory-built VLA version has one 73.5 kW (98.6 hp) Rotax 912 ULS flat-four driving two-blade Bruce de Chastel or Storch Aviation PROP-004 wooden propeller; 84.6 kW (113.4 hp) turbocharged Rotax 914 optional. Fuel in two wing tanks and a belly tank, combined capacity 90 litres (23.8 US gallons; 19.8 Imp gallons); a larger belly tank, capacity 100 litres (26.4 US gallons; 22.0 Imp gallons) optional.

ACCOMMODATION: Two, in tandem, with dual controls.

DIMENSIONS, EXTERNAL:

Wing span	10.00 m (32 ft 9 3/4 in)
Length overall	6.80 m (22 ft 3 3/4 in)
Height overall	2.40 m (7 ft 10 1/2 in)
Propeller diameter	1.88 m (6 ft 2 in)

DIMENSIONS, INTERNAL:

Cabin: Length	1.50 m (4 ft 11 in)
Max width	0.80 m (2 ft 7 1/2 in)
Max height	1.00 m (3 ft 3 3/4 in)

AREAS:

Wings, gross	16.00 m ² (172.2 sq ft)
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WEIGHTS AND LOADINGS (Storch 'Ultra'):

Weight empty	350 kg (772 lb)
Max T-O weight	544 kg (1,200 lb)

PERFORMANCE:

Never-exceed speed (VNE)	98 kt (181 km/h; 112 mph)
Max level speed	78 kt (144 km/h; 90 mph)
Cruising speed	70 kt (130 km/h; 81 mph)
Stalling speed, flaps down, power on	22 kt (41 km/h; 26 mph)
Max rate of climb at S/L	213 m (700 ft)/min
Service ceiling	4,575 m (15,000 ft)
T-O and landing run	9 to 15 m (30 to 50 ft)
Endurance: standard fuel	3 h 0 min
optional fuel	7 h 0 min
g limits	+6/-3

UTVA

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GENERAL MANAGER: Dipl Ing Tomislav Bjelogrić

PRODUCTION MANAGER: Dipl Ing Dragan Turkalj

AIRCRAFT DEVELOPMENT MANAGER: Dipl Ing Tonko Mihovilovic

Utva (Sheldrake) formed at Zemun, 5 June 1937; to Pančevo 1939. The 86,000 m² (925,700 sq ft) factory was heavily damaged during NATO air strikes on 24 March 1999, at which time development work on the G-4M Super Galeb, Lasta 2 primary/basic trainer and Utva-96 ceased. In late 2003 the company announced that it was restarting work on the Utva-96; in early 2004 it was announced that Utva would be separated from its parent company Lola prior to privatisation, scheduled for 7 October 2004 and that design work was under way on a new basic trainer, the Lasta 95. Privatisation was delayed, but Lola's share (amounting to 70 per cent of socially-owned capital or 23.51 per cent of total capital) was auctioned on 26 October 2006; however, the reserve price was not reached. The company is also developing unmanned aerial vehicles (UAVs) including the Gavran-I and Gavran-II, and aerial targets. No evidence of recent light aircraft activity.

DIMENSIONS, EXTERNAL:

Wing span	9.73 m (31 ft 11 in)
Wing chord	1.55 m (5 ft 1 in)
Wing aspect ratio	6.5
Length overall	7.11 m (23 ft 4 in)
Height overall	3.15 m (10 ft 4 in)
Tailplane span	3.80 m (12 ft 5 1/2 in)
Wheel track	2.58 m (8 ft 5 1/2 in)
Wheelbase	1.99 m (6 ft 6 1/4 in)
Propeller diameter	1.93 m (6 ft 4 in)
Propeller ground clearance	0.295 m (11 3/4 in)

AREAS:

Wings, gross	14.63 m ² (157.5 sq ft)
Ailerons (total)	1.38 m ² (14.85 sq ft)
Flaps (total)	1.61 m ² (17.33 sq ft)
Vertical tail surfaces (total)	1.78 m ² (19.16 sq ft)
Horizontal tail surfaces (total)	3.34 m ² (35.95 sq ft)

WEIGHTS AND LOADINGS (estimated):

Weight empty	710 kg (1,565 lb)
Max baggage weight	50 kg (110 lb)
Max T-O weight	1,210 kg (2,668 lb)
Max wing loading	82.7 kg/m ² (16.94 lb/sq ft)
Max power loading	9.03 kg/kW (14.84 lb/hp)

UTVA-96

TYPE: Four-seat lightplane.

PROGRAMME: Resumption announced in 2003 as a development of earlier two-seat Utva-75 trainer used by air forces and flying clubs of the former Yugoslavia, at which time two prototypes were under construction; no further information.

DESIGN FEATURES: Compared to earlier Utva-75, has strengthened fuselage to meet FAR Pt 23 requirements and redesigned engine cowling. Upgrade conversion kits for Utva-75 available.

FLYING CONTROLS: Conventional and manual. Fluted skin on ailerons, flaps, fin, rudder and elevators; rudder and elevators horn-balanced; ground-adjustable tab on rudder; Flettner trim tab on each aileron; Teleflex actuator for elevator control tab.

STRUCTURE: All-metal semi-monocoque.

LANDING GEAR: Tricycle type; fixed. Wing-mounted, cantilever main legs with trailing-link suspension and oleo-pneumatic shock-absorbers. Small tail bumper. Tyres, size 7.00-8 on mainwheels; size 6.00-6 on nosewheel; hydraulic brakes.

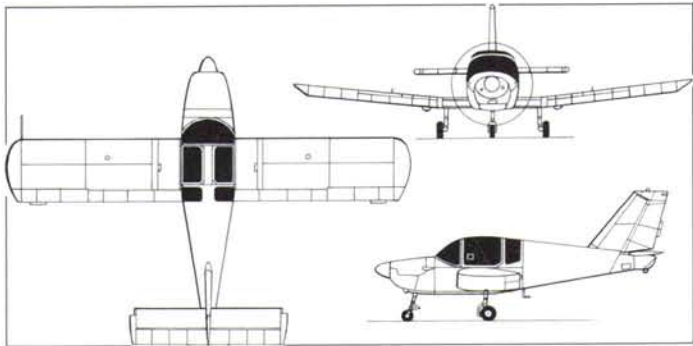
POWER PLANT: Initially, one 224 kW (300 hp) Textron Lycoming IO-540-L1A5D flat-six was proposed, but this was changed to one 134 kW (180 hp) Textron Lycoming IO-360-B1F by early 2006. Total fuel 153 litres (40.4 US gallons; 33.7 Imp gallons) in integral wing tanks.

ACCOMMODATION: Pilot and three passengers in two pairs of seats; single-piece front windscreen and larger side windows. Separate baggage compartment.

AVIONICS: Integrated system to meet IFR requirements.



Prototype UTVa-96 under construction 0567734



Utvá-96 four-seat lightplane (James Goulding) 1047690

PERFORMANCE (estimated):	
Max operating speed	103 kt (190 km/h; 118 mph)
Max cruising speed	94 kt (175 km/h; 109 mph)
Stalling speed	54 kt (100 km/h; 62 mph)
Max rate of climb at S/L	240 m (787 ft)/min
Service ceiling	4,000 m (13,120 ft)
T-O run	200 m (660 ft)
T-O to 15 m (50 ft)	400 m (1,315 ft)
Landing from 15 m (50 ft)	340 m (1,115 ft)
Landing run	180 m (590 ft)
Range with max fuel	324 n miles (600 km; 373 miles)

AEROPRO

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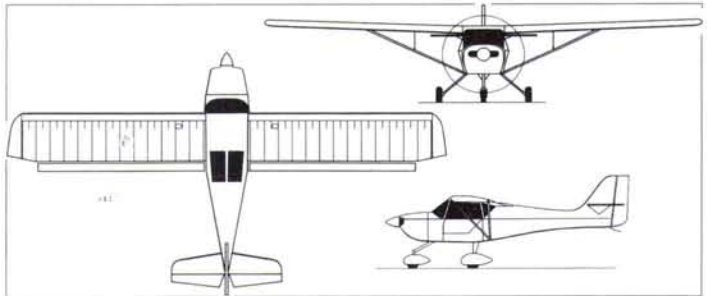
Light aviation supplies company Aeropro has been manufacturing aircraft since 1992. In 1995 it took over production of the Eurofox ultralight formerly marketed by EV-AT of Czech Republic and currently offers both tri-gear and tailwheel versions, including a towing version of the Eurofox Space.

AEROPRO EUROFOX

TYPE: Side-by-side ultralight/kitbuilt.
PROGRAMME: Adapted in 1990 from SkyStar (Denney) Kitfox, primarily for sale in Germany by Ikarusflug; renamed Eurofox in 1995. Certification to German Bauvorschriften für Ultraleichtflugzeuge (BFU) and Slovakian ultralight requirements was achieved in March 1996. Eurofox Pro (now Eurofox Space) now certified in Belgium, Czech Republic, France, Italy and Netherlands. The 1999 versions introduced increased cabin width and option of Rotax 912 ULS with provision for glider towing (Eurofox TOW). Eurofox Space certified as lightplane in Slovak Republic 17 June 2005.
CURRENT VERSIONS: **Eurofox Basic:** Tailwheel ultralight version; two-blade propeller. MTOW 450 kg (992 lb).
Eurofox Space: Introduced (as Eurofox Pro) 1999; JAR-VLA version with 480 kg (1,058 lb) MTOW; nosewheel. Improvements include increased cabin width, increased leg room (partly through raised instrument panel) and modified engine cowlings.
Note that many aircraft are still registered with the original type name **Fox**.
CUSTOMERS: The 100th was built in 2001 for a Dutch owner; company reported 183 built by October 2006, with examples flying in Belgium, Canada, Czech Republic, France, Germany, Italy, Morocco, Netherlands, Poland, Portugal, Slovakia and US.
COSTS: Kit: Eurofox Basic EUR27,300, Eurofox Space EUR27,850. Ready to fly: Eurofox Basic EUR45,900 (tailwheel), EUR46,290 (912 UL) or EUR47,350 (912 ULS) or EUR52,990 (TOW/912 ULS). (All prices excluding VAT, 2006.)
DESIGN FEATURES: Extensive redesign of SkyStar Kitfox (which see). Main changes are lengthened fuselage to improve longitudinal stability, NACA 4412 modified wing section, Junkers combined flaps/ailerons, more spacious cabin dimensions and revised landing gear.
FLYING CONTROLS: Conventional rudder and elevator, manually actuated (cables and pushrods respectively); 80 per cent span, rod-actuated mass-balanced Junkers-type flaperons, maximum deflection 20°.
STRUCTURE: Folding wings have two alloy tubing spars with diagonal bracing, alloy full and half ribs, glass fibre flaps and leading-edges and Ceconite or Poly-Fiber covering. Fuselage of welded 4130 chromoly steel tubing.
LANDING GEAR: Tailwheel type (fixed) on Eurofox Basic, (also known as Eurofox 2K) with cantilever main legs, hydraulic disc brakes and 15x6.00-6 (optionally 14x4.00-6) mainwheel tyres; tailwheel tyre size 210x65 mm. Eurofox Space has tricycle gear (Eurofox 3K) with steerable 4.00-4 nosewheel with rubber-in-compression suspension.
POWER PLANT: One 59.6 kW (79.9 hp) Rotax 912 UL flat-four four-stroke driving Woodcomp SR200 three-blade fixed-pitch wooden propeller or Faturik Fiti Eco Competition three-blade composite propeller. Alternatively, one 73.5 kW (98.6 hp) Rotax 912 ULS or one 59.7 kW (80 hp) Jabiru 2200. Fuel capacity 58 litres (15.3 US gallons; 12.8 Imp gallons) standard, of which 56 litres (14.8 US gallons; 12.3 Imp gallons) are usable. Optional capacity 82 litres (21.7 US gallons; 18.0 Imp gallons).
ACCOMMODATION: Baggage compartment behind seats. Upward-opening window/door each side.
SYSTEMS: Electrical system with 12 V 16 Ah battery and 250 W alternator.
AVIONICS: Optional avionics by Becker and Honeywell, including GPS, to customer's choice.
EQUIPMENT: FUSE 520 or BRS5UL4 parachute recovery system (optional).



Europro Eurofox side-by-side ultralight (Paul Jackson) 1158785



Aeropro Eurofox Space in its nosewheel version, with and without wheel fairings (Paul Jackson) 1127528

DIMENSIONS, EXTERNAL (A: Eurofox Basic, B: Eurofox Space):	
Wing span: A, B	9.125 m (29 ft 11¼ in)
Wing chord, constant portion, incl flaperons	1.30 m (4 ft 3¼ in)
Length: overall: A	6.00 m (19 ft 8¼ in)
B	5.73 m (18 ft 9½ in)
wings folded: A	6.10 m (20 ft 0¼ in)
B	6.20 m (20 ft 4 in)
Height overall: tailwheel (top of wing)	1.72 m (5 ft 7¾ in)
nosewheel (over tail)	2.05 m (6 ft 8¾ in)
Width overall, wings folded	2.40 m (7 ft 10½ in)
Tailplane span	2.32 m (7 ft 7¼ in)
Wheel track	1.94 m (6 ft 4½ in)
Wheelbase: A	4.10 m (13 ft 5½ in)
B	1.23 m (4 ft 0½ in)
Propeller diameter: Woodcomp	1.68 m (5 ft 6¼ in)
Faturik	1.60 m (5 ft 3 in)
DIMENSIONS, INTERNAL:	
Cabin max width: A	1.06 m (3 ft 5¾ in)
B	1.12 m (3 ft 8 in)
AREAS:	
Wings, gross: A, B	11.40 m² (122.7 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty (with parachute recovery system): A	279 kg (615 lb)
B	270 kg (595 lb)
Max T-O weight: A	450 kg (992 lb)
B	472.5 kg (1,041 lb)
PERFORMANCE (at 450 kg; 992 lb):	
Never-exceed speed (VNE)	99 kt (185 km/h; 115 mph)
Cruising speed at 75% power	86 kt (160 km/h; 99 mph)
Stalling speed	35 kt (65 km/h; 41 mph)
Max rate of climb at S/L	300 m (984 ft)/min
T-O to 15 m (50 ft)	190 m (625 ft)
Range: standard fuel	378 n miles (700 km; 435 miles)
optional fuel	648 n miles (1,200 km; 745 miles)

AEROSPOOL

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Czech Republic (www.piper.cz)

Denmark/Norway (www.ultrading.dk)

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Portugal (www.cvb-aerolazer.com)

Slovenia/Croatia (www.airnet.si)

South Africa (www.wt9dynamic.co.za)

Sweden/Denmark (www.lsas.se)

UK/Irish Republic (www.ylac.on)

US (www.skysops.org)

Aerospool's current product is the WT-9 Dynamic ultralight, but it also repairs and manufactures sailplanes for Schempp-Hirth and produces components for lightplanes assembled in Europe and USA. Factory covered area 1,700 m² (18,300 sq ft); workforce more than 100 in 2005.

AEROSPOOL WT-9 DYNAMIC

TYPE: Side-by-side ultralight/kitbuilt.

PROGRAMME: First flight 1999. Developed from Aerospool Impulz, designed by Tadeas Wala, winner of 1999 Slovak national prize for industrial design and subsequently marketed by Impulse Aircraft (which see). Public debut of Dynamic at Friedrichshafen, April 2001. Prototype (D-MXWT) in Speed configuration; c/n DY003 (D-MZKZ), in Club version, also exhibited. Certified by Slovak CAA 25 April 2005.

CURRENT VERSIONS: **Club**: Fixed gear and Rotax 912 UL/A/F engine. Also available from 2002 as **Club S** with more powerful Rotax 912 ULS/S.

Tow: More powerful Rotax and aero-tow equipped.

Speed: Same engine as Tow and Club S, but retractable gear.

CUSTOMERS: Total of 123 sold and further 30 ordered by March 2006.

COSTS: EUR74,900 (Club), EUR79,500 (Tow) and EUR87,600 (Speed), all including VAT (2004); avionics extra.

DESIGN FEATURES: Conventional low-wing monoplane; tapered wings; sweptback vertical tail surfaces. In 2004, WT-9 introduced extension to base of rudder in conjunction with rear fuselage 'bumper'.

Wing aerofoil section MS(1)-0313.



Aerospool WT-9 Dynamic (Paul Jackson)

1158789

FLYING CONTROLS: Conventional and manual. Horn-balanced ailerons, elevators and rudder, with pushrod actuation; no tabs. Slotted flaps (settings 0/15/24/35°).

STRUCTURE: Fuselage shells, including integral fin, are three-layer sandwich structures of carbon fibre (inner), glass fibre (outer) and hardened foam filling, reinforced with advanced composites in cockpit area. Front portion of wing centre-section box accommodates integral fuel tank. Rear portion contains stiffening ribs for attachment of mainwheel legs (Club and Tow); on Speed, this area serves as main gear retraction bay. Outer wing panels are torsion box structures (main spar and auxiliary), with carbon rod spar caps and GFRP sandwich skins. Movable surfaces are of sandwich shell construction.

LANDING GEAR: Tricycle type, fixed in Club and Tow versions, electrohydraulically retractable (but no wheel doors) in Speed version. Club and Tow have glass fibre self-sprung cantilever main legs. On Speed, levered suspension main legs retract inward; rearward-retracting nosewheel. Mainwheels 350 mm diameter, nosewheel 300 mm (with laminated speed fairings on Club and Tow). Hydraulic mainwheel disc brakes (all versions).

POWER PLANT: **Club**: One 59.6 kW (79.9 hp) Rotax 912 UL/A/F and Kremen SR 2000 three-blade, variable-pitch wooden propeller.

Club S Tow and Speed: One 73.5 kW (98.6 hp) Rotax 912 ULS/S; propeller Kremen SR 2000 or SR 3000 DUC three-blade.

Standard fuel capacity (all versions) 75 litres (19.8 US gallons; 16.5 Imp gallons); inboard integral tank in each wing. Optional capacity 128 litres (33.8 US gallons) 28.2 Imp gallons).

ACCOMMODATION: Dual controls. Front-hinged, upward-opening one-piece canopy. Space for 10 kg (22 lb) baggage behind seats.

AVIONICS: Optional, to customer's choice.

EQUIPMENT: Ballistic recovery parachute optional.

DIMENSIONS, EXTERNAL:

Wing span	9.00 m (29 ft 6 1/4 in)
Length overall	6.37 m (20 ft 10 3/4 in)
Height overall	2.00 m (6 ft 6 3/4 in)
Propeller diameter	1.70 m (5 ft 7 in)

DIMENSIONS, INTERNAL:

Cabin max width	1.15 m (3 ft 9 1/4 in)
Baggage volume	0.09 m ³ (3.2 cu ft)

AREAS:

Wings, gross	10.35 m ² (111.4 sq ft)
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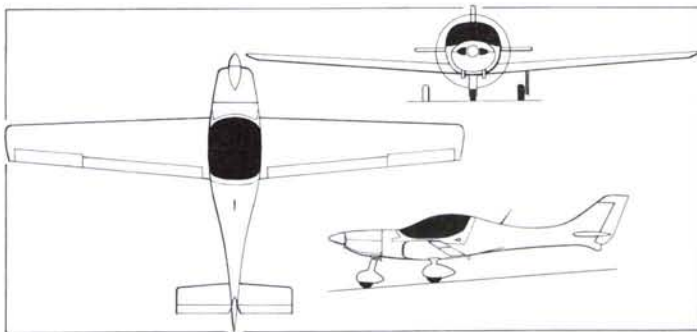
WEIGHTS AND LOADINGS:

Weight empty: Club	264 kg (582 lb)
Tow	267 kg (589 lb)
Speed	274 kg (604 lb)
Max T-O weight: all	450 kg (992 lb) ¹

¹ 472.5 kg (1,041 lb) permitted in Germany

PERFORMANCE:

Never-exceed speed (VNE): all	151 kt (280 km/h; 174 mph)
Normal operating limit speed (VNO)	135 kt (250 km/h; 155 mph)
Stalling speed: flaps up	42 kt (77 km/h; 48 mph)
flaps down	36 kt (65 km/h; 41 mph)
Max rate of climb at S/L: Club	384 m (1,260 ft)/min
Tow, Speed	311 m (1,020 ft)/min
T-O run: Club	76 m (250 ft)
Tow, Speed	71 m (235 ft)
T-O to 15 m (50 ft): Club	254 m (835 ft)
Tow, Speed	237 m (780 ft)
Landing from 15 m (50 ft): all	255 m (840 ft)
Landing run: all	149 m (490 ft)
Max range (optional fuel): all	1,079 n miles (2,000 km; 1,242 miles)
g limits: all	+5/-3



Aerospool WT-9 Dynamic two-seat ultralight in fixed (side view) and retractable gear (nose view) form (James Goulding)

1127525

EKOFLUG

EKOFLUG SPOL S. R. O.

Košice Airport, SR-070 20

Tel/Fax: (+421 95) 42 31 53

DIRECTOR: Ivo Vacek

Ekoflug builds the CH 701 ultralight which is distributed in Italy by ICP under the name of Savannah.

EKOFLUG MXP-740

TYPE: Side-by-side ultralight.

PROGRAMME: Modified version of Zenith Zenair STOL CH 701, with increased wing span and Rotax 912 engine as standard.

CURRENT VERSIONS: **MXP-740**: Baseline version.

Savannah: Italian and UK marketing name: Experimental category. As described.

Savannah Turbo: With 89.4 kW (120 hp) engine modified by ICP.

Savannah Hydro: Floatplane; 500 kg (1,102 lb) MTOW.

Bingo: Italian marketing name: Ultralight category; formerly Savannah Light.

CUSTOMERS: More than 300 built. Exported to Belgium, France, Germany, Israel, Netherlands, Norway, South Africa, Tanzania, UK and elsewhere.

COSTS: UK kit prices ex-Italy: airframe GBP12,250; airframe and Jabiru 2200 engine GBP19,750; both including VAT (2004).

DESIGN FEATURES: As CH 701; wing section NACA 65018 (modified). Quoted build time 400 hours.

FLYING CONTROLS: Flaperon deflections: 20° take-off; 40° landing; rudder deflection 25° each way, ailerons maximum deflection 15°.

POWER PLANT: One 59.6 kW (79.9 hp) Rotax 912 UL flat-four engine; DUC two- or three-blade propeller. Alternatively, 59.7 kW (80 hp) Jabiru 2200 or similarly rated Suzuki G10 three-cylinder inline engine. Fuel capacity 80 litres (21.1 US gallons; 17.6 Imp gallons), of which 77 litres (20.3 US gallons; 16.9 Imp gallons) usable.

For details of the latest updates to *Jane's All the World's Aircraft* online and to discover the additional information available exclusively to online subscribers please visit
jawa.janes.com

Data follow for Jabiru engine.

DIMENSIONS, EXTERNAL:	
Wing span	9.00 m (29 ft 6¼ in)
Length overall	6.10 m (20 ft 0¼ in)
Height overall	2.90 m (9 ft 6¼ in)
AREAS:	
Wings, gross	12.96 m ² (139.5 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	260 kg (573 lb)
Max T-O weight	450 kg (992 lb)
PERFORMANCE:	
Max level speed	78 kt (145 km/h; 90 mph)
Max cruising speed	65 kt (120 km/h; 75 mph)
Stalling speed: flaps down	28 kt (52 km/h; 32 mph)
T-O run	40 m (135 ft)
g limits	+6/-4



Ekoflug-built, ICP-marketed MXP-740 Savannah (Paul Jackson)

1158584

LOBB

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Lobb was established on 1 January 1993 by renaming of the IDEIX company, formed in 1939. Current business mainly concerns electrical generation plant. However, the Falco 95 was launched in Western Europe at the Blois air show, France, in September 2004.

LOBB FALCO 95

TYPE: Side-by-side ultralight kitbuilt.
PROGRAMME: Prototype OM-JURO. Marketing began in 2004.
COSTS: EUR18,800 plus taxes, excluding engines and instruments (2006).
DESIGN FEATURES: High wing braced by V struts with intermediate struts. Sweptback fin with fillet. Tailplane braced below to tailskid. Wings foldable for storage. Quoted build time 120 hours, excluding engine installation.
Wing section NACA 2412.
FLYING CONTROLS: Conventional and manual. Flaps.
STRUCTURE: Steel tube fuselage generally Dacron-covered, but with local aluminium sheet. Aluminium wings with Dacron covering, including control surfaces.
LANDING GEAR: Tricycle type; fixed. Fuselage-mounted, spring cantilever mainwheel legs. Trailing-link nosewheel with compressed rubber shock-absorber. Cable actuated hydraulic brakes. Mainwheels 150x240; nosewheel 12x4.



Lobb Falco 95 on display at Blois in September 2004 (Bob Sage)

1044621

POWER PLANT: One flat-four piston engine. Air-cooled Jabiru 2200 of 59.7 kW (80 hp) initially. Water-cooled 59.6 kW (79.9 hp) Rotax 912 available from 2005. Other options include 48.0 kW (64.4 hp) Rotax 582. Fuel capacity 55 litres (14.5 US gallons; 12.1 Imp gallons).
EQUIPMENT: Optional ballistic parachute.
DIMENSIONS, EXTERNAL:
Wing span

9.58 m (31 ft 5¼ in)

Length overall

6.31 m (20 ft 8½ in)

Height overall

2.28 m (7 ft 5¾ in)

AREAS:

Wings, gross

12.92 m² (139.1 sq ft)

WEIGHTS AND LOADINGS (Jabiru engine):

Weight empty

272 kg (600 lb)

Max T-O weight

450 kg (992 lb)

PERFORMANCE:

Max operating speed

97 kt (180 km/h; 112 mph)

Stalling speed, flaps down

36 kt (65 km/h; 41 mph)

Max rate of climb at S/L

210 m (689 ft)/min

T-O run

135 m (443 ft)

Slovenia

AMS

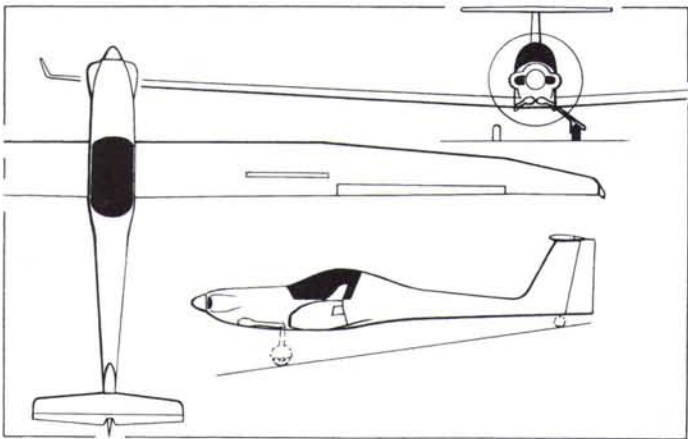
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As well as producing parts for Glaser-Dirks sailplanes and distributing that company's DG-303 and DG-505 AMS-Flight has taken over production and marketing for the former Technoflug TFK-2 Carat. Starting in 1978, by 19 September 2006, AMS had produced 1,119 sailplanes and motorgliders, including 28 Carats. At this time the workforce totalled 55. Some 94 per cent of production is exported.
In 2005, preliminary design details of the Magnus series of motorgliders were released.

AMS CARAT A

TYPE: Single-seat motor glider ultralight.
PROGRAMME: First flown 16 December 1997; flight testing carried out during 1998. Initial production aircraft displayed at Aero '99, Friedrichshafen, in April 1999 under name of Technoflug TFK-2 Carat. Folding propeller certified 7 November 2000; certified by LBA 15 July 2001. Promotion and marketing transferred to AMS, which displayed fourth aircraft at Aero '03, Friedrichshafen, April 2003.
CUSTOMERS: Six built by 1 January 2004, including exports to Germany, Switzerland and US (13 aircraft by 19 September 2006). Total 28 built by April 2005.
COSTS: USD69,635 (2001) without avionics.
DESIGN FEATURES: Low wing of 21.3 aspect ratio; optional winglets; T tail. Uses wings and horizontal tail (but not water tank) of Schempp-Hirth Discus sailplane, with main spar passing under pilot's knees; wings and tailplane can be detached for storage and aircraft will fit into sailplane trailer. Optional winglets.
FLYING CONTROLS: Conventional and manual. Schempp-Hirth airbrakes on upper wing surfaces and 'turbulators' below.

STRUCTURE: Generally of glass fibre and carbon fibre composites. Wings have PVC foam cores.
LANDING GEAR: Tailwheel type; retractable. Mainwheels, size 4.00-4 in, retract inwards and forwards electrohydraulically with manual override; fixed steerable 210x65 mm tailwheel. Hydraulic disc brakes. Parking brake.
POWER PLANT: One 1,800 cc (109.8 cu in) Sauer E1S conversion of Volkswagen four-stroke, air-cooled motorcar engine, producing 40 kW (53.6 hp) at max continuous power, driving a 1.40 m (4 ft 7 in) Technoflug KS-F3-1A/140-1 fixed-pitch propeller, blades of which are held forward by gas damping springs located under the spinner when not turning. Other planned engines include 59.6 kW (79.9 hp) Rotax 912. Fuel capacity 53 litres (14.0 US gallons; 11.7 Imp gallons) in single fuel tank situated between cockpit and engine.
SYSTEMS: Electric starter and generator; 12 V 16 Ah battery. Electric fuel pump.



AMS Carat (Volkswagen motorcar engine) (James Goulding)

1158576



AMS Carat A motor glider (Paul Jackson) 1129257

AVIONICS: Suggested package includes ATR720A radio, Honeywell transponder and Filser DX50FAI GPS.

DIMENSIONS, EXTERNAL:

Wing span 15.00 m (49 ft 2½ in)

Length overall 6.21 m (20 ft 4½ in)

DIMENSIONS, INTERNAL:

Baggage compartment volume 0.1 m³ (3.53 cu ft)

AREAS:

Wings, gross 10.58 m² (113.9 sq ft)

WEIGHTS AND LOADINGS:

Weight empty 325 kg (717 lb)

Max baggage weight 145 kg (320 lb)

Max T-O weight 470 kg (1,036 lb)

PERFORMANCE, POWERED:

Never-exceed speed (VNE) 135 kt (250 km/h; 155 mph)

Normal cruising speed at 75% power 116 kt (214 km/h; 133 mph)

Stalling speed 44 kt (80 km/h; 50 mph)

Max rate of climb at S/L 210 m (689 ft)/min

T-O run 226 m (741 ft)

Landing run 137 m (450 ft)

Range with max fuel, 30 min reserves 554 n miles (1,026 km; 637 miles)

g limits +5.3/-2.65

PERFORMANCE, UNPOWERED:

Stalling speed 44 kt (80 km/h; 50 mph)

Best glide ratio 35

Min rate of sink 0.75 m (2.46 ft)/s

AMS MAGNUS

TYPE: Side-by-side motor glider ultralight.

PROGRAMME: First announced (on company's website) 2005; development was continuing during 2006.

CURRENT VERSIONS: **AM11:** Baseline version; *as described*.

AM21: Longer wingspan version: as AM11, unless otherwise indicated.

DESIGN FEATURES: Low wing with upturned outer panels and winglets; constant-chord centre-section; two-stage sweepback outboard on AM21, or single-stage on AM11; main spar passes beneath pilot's knees. Sweepback fin and T-tail.

FLYING CONTROLS: Conventional and manual. Flaps.

STRUCTURE: Composites throughout.

LANDING GEAR: Tricycle type, fixed. Speed fairings on all wheels.



AMS Magnus AM21 1129236

POWER PLANT: Choice of 59.7 kW (80 hp) Sauer S2100 UL, or Jabiru 2200, or 73.5 kW (98.6 hp) Rotax 912ULS engine driving a three-blade, fixed-pitch Duc propeller or (AM11 only) two-blade, fixed-pitch AMS folding propeller. Fuel capacity 70 litres (17.2 US gallons; 14.3 Imp gallons).

ACCOMMODATION: Side-by-side seating under single-piece canopy/windscreen.

DIMENSIONS, EXTERNAL:

Wing span: AM11 10.60 m (34 ft 9¼ in)

AM21 13.35 m (43 ft 9½ in)

Length overall 6.63 m (21 ft 9 in)

Height overall 2.17 m (7 ft 1½ in)

AREAS:

Wings, gross: AM11 10.53 m² (113.3 sq ft)

AM21 11.69 m² (125.8 sq ft)

WEIGHTS AND LOADINGS:

Weight empty: AM11: Rotax 250 kg (551 lb)

Sauer 240 kg (529 lb)

Jabiru 235 kg (518 lb)

AM21: Rotax 255 kg (562 lb)

Sauer 245 kg (540 lb)

Jabiru 235 kg (518 lb)

Max T-O weight (all versions) 470 kg (1,036 lb)

PERFORMANCE (Rotax 912 ULS):

Never exceed speed (VNE): AM11 164 kt (305 km/h; 189 mph)

AM21 156 kt (290 km/h; 180 mph)

Normal cruising speed at 75% power: AM11 138 kt (256 km/h; 159 mph)

AM21 136 kt (252 km/h; 157 mph)

Stalling speed: flaps down: AM11: 35 kt (64 km/h; 40 mph)

AM21 34 kt (62 km/h; 39 mph)

Max rate of climb at S/L: AM11 498 m (1,634 ft)/min

AM21 570 m (1,870 ft)/min

T-O run: AM11 102 m (335 ft)

AM21 84 m (275 ft)

Range: AM11 669 n miles (1,240 km; 770 miles)

AM21 756 n miles (1,400 km; 870 miles)

PIPISTREL

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Web: www.pipistrel.si
GENERAL MANAGER: Ivo Boscarol

Pipistrel originated in mid-1980s when partners Ivo Boscarol and Bojan Sajovic began building flex-wing trikes. First major design was Ajdovščina, of which 32 built between 1989 and December 1992, including exports to Italy (these first private Yugoslav exports of light aircraft). Also began producing ground-adjustable pitch propellers, of which 1,400 built by 2000. Pipistrel Plus flex-wing entered production in 1990; more than 200 now sold. Supplied flex-wings to Croatian Army in 1991. Spider flex-wing entered production in 1992; more than 150 produced. Company formally established as Pipistrel d.o.o. on 18 November 1992 and supplied flex-wings to Italian Army's special forces in following year. Twister flex-wing introduced 1998. Moved to new premises at Ajdovščina aerodrome in 2001; workforce 18. Production rate four aircraft per month in mid-2003. Construction of new assembly facility at Ajdovščina airport (more than 2,000 m²; 21,528 sq ft) started 5 September 2003; completed 2004; enabled immediate increase in output from four aircraft per month to seven, aiming to reach 10 per month by mid-2005. Sinus/Virus production reached 200 total in March 2006. In 2000, Pipistrel began design of Arcus ultralight, no details of which have yet been published. In 2005 the company also began deliveries of the Taurus self-launching ultralight sailplane which has a 'pop-up' Rotax 503 engine and made its maiden flight on 15 May 2004. Company now also produces Taurus PureGlider (no engine), which made its first flight 25 August 2006.

PIPISTREL SINUS

TYPE: Side-by-side ultralight motor glider/kitbuilt.

PROGRAMME: Design begun 1994; project leader Franco Orlando. Prototype (S5-NBP) built and certified in Slovenia; public debut at Aero '95, Friedrichshafen, April 1995, but not flown until 1996. Series production from 1999. Marketed in France by Zen ULM and

elsewhere. Kit versions introduced 1 April 2004 (51 per cent kit to meet FAA requirements and quick-build QBK).

Between 6 June and 25 August 2004, pilot Matevz Lenarcic completed a round-the-world solo flight in the Sinus 912 S5-PCT. Maiden flight 9 March 2006 of 200th member of Sinus/Virus family, a tri-gear Sinus 912 for a customer in Taiwan.

CURRENT VERSIONS:

Sinus 503: 37.0 kW (49.6 hp) Rotax 503 UL-2V two-stroke and Pipistrel variable-pitch, folding propeller. Certified in Australia, Belgium, Colombia, Croatia, France, Hungary, Italy, Japan, Poland and Slovenia.

Sinus 912: 59.6 kW (79.9 hp) Rotax 912 UL-2 flat-four with Pipistrel variable-pitch, folding propeller. *As described*. Certified in same countries as 503.

CUSTOMERS: Sold in 11 European countries, including 54 to French customers by 2002. Others to Australia, Brazil, Colombia, Congo, Eritrea, Japan, Kenya, Mexico, New Caledonia, Reunion Islands, Santo Domingo, South Africa, Taiwan, Thailand, US and Venezuela. Total sales (including Virus) 200 by March 2006.



Pipistrel Sinus displayed at African Aerospace and Defence show in September 2006 (Jane's/Patrick Allen) 1196458

COSTS: Sinus 503 EUR49,200; Sinus 912 EUR60,700 ready to fly. Kit versions: 912 51 per cent EUR51,900, QBK EUR56,500; 503 51 per cent EUR42,000, QBK EUR46,200. (All 2005).

DESIGN FEATURES: Meets JAR 22 specifications. Pod-and-boom fuselage with high cantilever wing (except on prototype, which was strut-braced), upturned wingtips, and strut-braced T tail. in-Flight-adjustable pitch propeller for improved engine-off performance; can be feathered for gliding.

Aerofoil section Orlando-Venuti IMD 029-b.

Wing is employed by Albistar Apis single-seat sailplane.

FLYING CONTROLS: Conventional elevator and rudder, manually operated. Flight-adjustable trim tab in starboard elevator. Flaperons on inboard 90 per cent of wing trailing-edge, deflections -5, +9, +18°. Schempp-Hirth-type spoilers in upper wing, one per side.

STRUCTURE: Principally of glass fibre, carbon fibre and Kevlar. Quoted build time 200 hours for QBK kits.

LANDING GEAR: Tailwheel type; fixed. Fuselage-mounted spring cantilever main legs with speed fairings, Hydraulic disc brakes on mainwheels.

POWER PLANT: One Rotax piston engine, as under Current Versions. Pipistrel Vario in-Flight-adjustable pitch two-blade composites propeller. Fuel in two tanks, combined capacity 60 litres (15.9 US gallons; 13.2 Imp gallons), of which 54 litres (14.3 US gallons; 11.9 Imp gallons) usable.

ACCOMMODATION: Two persons, side by side in enclosed cockpit, each with upward-opening door.

EQUIPMENT: BRS ballistic parachute systems optional.

Data for Sinus 912.

DIMENSIONS, EXTERNAL:

Wing span 14.97 m (49 ft 1 1/4 in)
Length overall 6.60 m (21 ft 7 3/4 in)
Height overall 1.70 m (5 ft 7 in)

DIMENSIONS, INTERNAL:

Cabin max width 1.10 m (3 ft 7 1/4 in)

AREAS:

Wings, gross 12.26 m² (132.0 sq ft)

WEIGHTS AND LOADINGS:

Weight empty 284 kg (626 lb)
Max T-O weight 450 kg (992 lb)¹

¹ 472.5 kg (1,041 lb) in France if fitted with ballistic parachute; 544 kg (1,200 lb) in Australia (AUF rules)

PERFORMANCE, POWERED:

Never-exceed speed (VNE) 121 kt (225 km/h; 139 mph)
Max level speed 119 kt (220 km/h; 137 mph)
Cruising speed 108 kt (200 km/h; 124 mph)
Stalling speed: flaps up 36 kt (66 km/h; 41 mph)
flaps down 34 kt (63 km/h; 40 mph)
Max rate of climb at S/L 390 m (1,280 ft)/min
Service ceiling 8,800 m (28,875 ft)
T-O run 88 m (290 ft)
Range 647 n miles (1,200 km; 745 miles)
g limits +4/-2

PERFORMANCE, UNPOWERED:

Best glide ratio at 51 kt (95 km/h; 59 mph), folded propeller 27
Min rate of sink at 49 kt (90 km/h; 56 mph), folded propeller 1.03 m (3.4 ft)/s

PIPISTREL VIRUS

TYPE: Side-by-side ultralight.



Pipistrel Virus with engine exposed (Paul Jackson)

1158786

PROGRAMME: Variant of Pipistrel Sinus; development began 1997; first flown (S5-PBG) 1999; series production from 2000. 912 certified in Australia, France, Italy, New Zealand and Slovenia. Company demonstration team created in 2003 with three Virus 912s (S5-PCA, 'PBR and 'PCP).

CURRENT VERSIONS: **Virus 582:** Power plant as for Sinus 582. Certified in Australia, New Zealand and Slovenia. No recent sales known.

Virus 912: Certified version; as described. Customers in South Africa, Thailand, US and elsewhere.

COSTS: Virus 912 EUR60,700 ready to fly; 51 per cent kit EUR51,900, QBK EUR56,500 (2005).

DESIGN FEATURES: Tricycle landing gear and shorter span standard; tailwheel version also certified in France. Otherwise generally as Sinus.

FLYING CONTROLS: As Sinus.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring cantilever mainwheel legs with wheel fairings; steerable nosewheel.

POWER PLANT: One Rotax 912 UL flat-four (59.6 kW; 79.9 hp) and Pipistrel Vario in-flight-adjustable, featherable two-blade carbon fibre propeller. Fuel capacity as Sinus.

Data for Virus 912.

DIMENSIONS, EXTERNAL:

Wing span 12.36 m (40 ft 6 1/2 in)
Length overall 6.40 m (21 ft 0 in)
Height overall 2.00 m (6 ft 6 3/4 in)

AREAS:

Wings, gross 11.00 m² (118.4 sq ft)

WEIGHTS AND LOADINGS:

Weight empty 285 kg (628 lb)
Max T-O weight 450 kg (992 lb)¹

¹ 472.5 kg (1,041 lb) in France if fitted with ballistic parachute

PERFORMANCE, POWERED (at 450 kg MTOW):

Never-exceed speed (VNE) 134 kt (249 km/h; 154 mph)
Max level speed, fixed prop 130 kt (240 km/h; 149 mph)
Cruising speed, fixed prop 121 kt (225 km/h; 140 mph)
Stalling speed: flaps up 39 kt (72 km/h; 45 mph)
flaps down 35 kt (64 km/h; 40 mph)
Max rate of climb at S/L 372 m (1,220 ft)/min
Service ceiling 8,100 m (26,575 ft)
T-O run 90 m (295 ft)
Range 691 n miles (1,280 km; 795 miles)
g limits +4/-2

PERFORMANCE, UNPOWERED:

Best glide ratio at 52 kt (110 km/h; 68 mph) 24
Min rate of sink at 52 kt (96 km/h; 60 mph) 1.80 m (5.91 ft)/s

South Africa

CHAYAIR

CHAYAIR MANUFACTURING AND AVIATION

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DIRECTORS: Norman Shelley

Wessel Visser

Company formed January 1997 by Messrs Shelley and Visser to develop, manufacture and market Sycamore gyrocopter. Name derived from Hebrew chay (pronounced *ghay*) meaning to prosper. Also manufactured under licence in Iran by Paravar Pars Company.

CHAYAIR SYCAMORE

TYPE: Two-seat autogyro ultralight/kitbuilt.

PROGRAMME: Flight testing of Mk 1 completed in mid-1998; production began September 1998. Marketed in Iran by Paravar Pars.

CURRENT VERSIONS: **Sycamore Mk 1:** Enclosed cockpit version; can be flown with doors removed.

Sycamore Mk 2000: Open cockpit version.

CUSTOMERS: Most sales in South Africa (33 Mk 1 and five Mk 2000 registered by September 2005); total of at least 50 produced, including one each to Iran, Namibia, Sweden and US.

COSTS: Available factory-assembled; or as kit, with or without engine; prices USD63,425, USD59,890 and USD45,420, respectively (2006).

DESIGN FEATURES: Conventional small autogyro built around aluminium boom supporting empennage and seating; engine mounted on rear of rotor cabane. Mechanical prerotorator (180 rpm); mechanical rotor brake. Large fin and rudder; dihedral tailplanes with large winglets plus, on later versions, auxiliary fins at half span. Option of three rotor sizes: all NACA H-8-12 section.

STRUCTURE: Chassis of bolted 6261-T6 aluminium. Composites empennage and cabin.



Chayair Sycamore Mk 1 (Jane's/Patrick Allen)

1110429

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted, spring cantilever mainwheel legs in current version. Tyres 400 mm; cable-operated drum brakes on mainwheels.

POWER PLANT: One 84.5 kW (113.3 hp) Rotax 914F turbocharged, water-cooled flat-four driving Arplast three- (optionally four-) blade propeller. Also offered with 127 kW (170 hp) Subaru EA81 conversion. Fuel capacity 53 litres (14.0 US gallons; 11.7 Imp gallons).

ACCOMMODATION: Two persons in tandem, with dual controls.

SYSTEMS: Electrical system 12 V DC.

DIMENSIONS, EXTERNAL:	
Rotor diameter: option 1	8.23 m (27 ft 0 in)
option 2	8.84 m (29 ft 0 in)
option 3	9.45 m (31 ft 0 in)
Fuselage length	5.40 m (17 ft 8½ in)
Height overall	2.675 m (8 ft 9¼ in)
Max width (at wheel fairings)	2.05 m (6 ft 8¾ in)
Tailplane span	1.80 m (5 ft 10¾ in)
AREAS:	
Rotor disc: option 1	53.19 m² (572.5 sq ft)
option 2	61.36 m² (660.5 sq ft)
option 3	70.11 m² (754.7 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	380 kg (838 lb)
Max T-O weight	590 kg (1,300 lb)
PERFORMANCE:	
Never-exceed speed (VNE)	87 kt (161 km/h; 100 mph)
Cruising speed at 75% power: option 1	70 kt (129 km/h; 80 mph)
option 2	65 kt (121 km/h; 75 mph)
option 3	59 kt (109 km/h; 68 mph)
Max rate of climb at S/L	305 m (1,000 ft)/min



Chayair Sycamore Mk 1 (James Goulding)

1158065

Service ceiling	4,000 m (13,120 ft)
T-O run	150 m (495 ft)
Landing run	up to 15 m (50 ft)
Endurance	2 h 30 min

DART

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PRODUCTION DIRECTOR: Dave Dormer

SALES DIRECTOR: Peter Dale

US DISTRIBUTION: Jeff Le Tempt

Dart Industries purchased the Dragonfly programme from Slipstream International of the USA in March 2004 and is offering both plans and kits.

DART DRAGONFLY

TYPE: Side-by-side ultralight kitbuilt.

PROGRAMME: Prototype first flight 16 June 1980, designed by Bob Walters; awarded Outstanding New Design trophy at EAA Oshkosh 1980. Initially marketed by Walter's Viking Aircraft as kit or as plans, passed to Viking Aircraft of Arizona in 1983, which became Viking Aircraft of Nevada in 1999. Programme sold to Slipstream International, then transferred to Dart in March 2004.

CURRENT VERSIONS: **Dragonfly Mark I:** Original configuration, with non-retractable mainwheels at tips of foreplane. EAA Oshkosh Outstanding Design, 1980.

Dragonfly Mark II: In parallel production, for operation on unprepared strips and narrow taxiways. Main landing gear in short non-retractable cantilever units under wings, with individual hydraulic toe brakes, and increased foreplane and elevator areas; wheel track 2.44 m (8 ft).

Dragonfly Mark III: Flight tested in 1985; non-retractable, narrow-track tricycle landing gear with steerable nosewheel and cantilever mainwheel legs attached to fuselage. **Mark III Millenium** displayed at EAA AirVenture, Oshkosh, July 2001 (N204AS, then unflown) as conversion of earlier aircraft. Recommended engines: 59.7 kW (80 hp) Jabiru 2200 flat-four or 89 kW (120 hp) Jabiru 3300 flat-six.

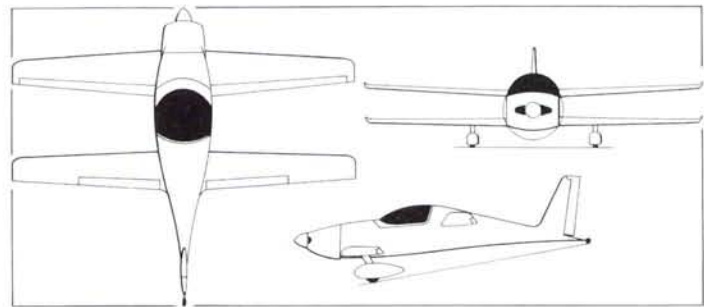
CUSTOMERS: More than 100 kits delivered, together with 2,000 sets of plans; some 70 kitbuilt and more than 430 plans-built aircraft flying.

COSTS: Standard kit, including Jabiru 2200 engine, USD38,500 (2003).

DESIGN FEATURES: Unconventional shoulder-wing monoplane with equal-span foreplane; latter also mounting landing gear in one of two alternative locations.

Quoted build time 1,000 hours, or 500 hours for quick-build kit.

Wing section Eppler 1213. Foreplane GU25 section. Thickness/chord ratio 15 per cent;



Dart Dragonfly Mark II (Paul Jackson)

0016522



Dart Dragonfly registered in the Netherlands

1179037

dihedral 3°; no incidence or sweepback. Foreplane t/c 17 per cent; anhedral 3° on Mk I or dihedral on Mk II; incidence -1°; no sweepback.

FLYING CONTROLS: Manual. Ailerons on inboard trailing-edge of wing; near full-span elevators on foreplane; horn-balanced rudder. Flettner tab on each foreplane.

STRUCTURE: Composites wing; foreplane and tail unit structures of styrene foam, glass fibre, carbon fibre and epoxy. Semi-monocoque fuselage, formed (not carved) from 12.5 mm (½ in) thick urethane foam, with strips of 18 mm (¾ in) foam bonded along edges to allow large-radius external corners. Fuselage covered with glass fibre inside and out.

LANDING GEAR: See Current Versions; employs choice of sprung steel or glass fibre landing gear. Brakes fitted. Wheelsize 12 cm (5 in) on Mark I and II, tyre size 11x400x5, with option of 600x6 on larger wheels for Mark II.

POWER PLANT: Mk I and II have one 44.5 kW (60 hp) 1,835 cc modified Volkswagen motorcar engine; 1,600 cc engine, rated at 33.5 kW (45 hp), optional. Fuel capacity 56.8 litres (15.0 US gallons; 12.5 Imp gallons).

DIMENSIONS, EXTERNAL:	
Wing span	6.71 m (22 ft 0 in)
Foreplane span	6.71 m (22 ft 0 in)
Length overall	5.79 m (19 ft 0 in)
Height overall: Mk I	1.22 m (4 ft 0 in)
Mk III	1.68 m (5 ft 6 in)

DIMENSIONS, INTERNAL:	
Cabin: Max width	1.09 m (3 ft 7 in)
Height	0.79 m (2 ft 7 in)

AREAS:	
Wings, gross	4.24 m² (45.6 sq ft)
Foreplane, net	4.33 m² (46.6 sq ft)

WEIGHTS AND LOADINGS (Millenium, Jabiru 2200):	
Weight empty	272 kg (600 lb)
Max T-O weight	567 kg (1,250 lb)

PERFORMANCE (Millenium, Jabiru 2200):	
Never-exceed speed (VNE)	156 kt (290 km/h; 180 mph)
Cruising speed	113 kt (209 km/h; 130 mph)
Stalling speed	48 kt (89 km/h; 55 mph)
Max rate of climb at S/L	259 m (850 ft)/min
T-O to 50 ft (15 m)	366 m (1,200 ft)
Landing from 50 ft (15 m)	610 m (2,000 ft)
Range	434 n miles (804 km; 500 miles)
g limits	+4.4/-2.0

DENEL

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EXECUTIVE DIRECTOR, AEROSPACE GROUP: Knox Msebenzi

DIVISIONAL GENERAL MANAGER: Trevor van Zyl

COMMUNICATION CONSULTANT: Nancy Phala

Predecessor Atlas Aircraft Corporation founded 1964 by Bonuskor as private company; delivered first Impala Mk 1 (Aermacchi MB-326) jet trainers to SAAF 1966; manufacturing, design and development facilities for airframes, engines, missiles and avionics; developed Cheetah from Mirage III, Rooivalk from Puma, Oryx (Super Puma) from Puma, V3B and V3C dogfight missiles, and many weapons installations. Incorporated into Armscor Group 1969; restructuring of Armscor on 1 April 1992 created Denel as self-sufficient commercial industrial group, in which Atlas Aviation became military aircraft manufacturing branch of Simera in Denel Aerospace Group. Renamed Denel Aviation in April 1996. Further reorganisation of 2004 placed Aerospace Group as one of three major Denel businesses (with Land Systems Group and Commercial & IT). Aerospace Group now comprises Denel Aerospace Systems, Denel Optronics and Denel Aviation, of which last-named is further divided as follows:

Airframe Manufacturing: At Kempton Park (part of Denel Aviation); Gripen landing gear, rear fuselage and pylons; Hawk tailplane, airbrake and flaps; Rooivalk complete aircraft; Boeing 737, 747 and 777 minor parts.

Aerospace Engineering: At Kempton Park and Irene. Aerospace structural and avionics engineering, manufacture and testing.

Aircraft Logistics: At Kempton Park. Support, repair and refurbishment, including C-130 Hercules, Rooivalk and Cheetah.

OTB Test Range: At Bredasdorp. Weapons performance; satellite launch support.

South African government selected BAE Systems as strategic equity partner for a partial privatisation of Denel Aviation on 12 October 2000; approval for BAE to acquire a 30 per cent holding in Denel Aviation for ZAR375 million (USD36.8 million) was announced in May 2002, but not taken up. Alternative equity partner sought in 2003; in November that year, Denel announced intention to separate its aerostructures and component manufacturing operations as part of a move to restore profitability.

South African government provided Denel Group parent (workforce 10,750) with ZAR2 billion in early 2006, to offset losses of ZAR1.6 billion in 2005 and expected further loss in 2006. This was followed on 15 June 2006 by announcement that Saab and Denel had signed agreement to create new aerostructures company in South Africa to compete internationally in civil and defence markets. Initial ownership is Saab 20 per cent, Denel 80 per cent, with a ZAR66 million investment by Saab and a proportional investment by Denel; start-up workforce includes about 600 Denel personnel.

MoU in late 1998 provided for co-production of, and export licence for, Agusta A 119 Koala helicopter; July 2000 agreement with Agusta, covering airframe manufacture and systems installation for 25 of 30 A109s ordered by South African Air Force, was extended in 2001 to include airframes of 20 A 109Ms for Sweden. This followed in December 2001 by agreement with AgustaWestland to produce and market A 109LUH, A 109 Power and A 119 Koala for customers in specified countries in Southeast Asia, the Middle East, South America, Africa and elsewhere. Final assembly of first (Italian-built) A109LUH for South African Air Force (1-PLUH/4001) began in early 2003; first of 25 to be assembled locally by Denel (4006) made maiden flight 9 September 2004; first four (fifth/last Italian-built and first three Denel-assembled) handed over to SAAF at Bloemfontein AB on 19 October 2005; nine delivered by June 2006. SAAF has option on further 10 A109LUHs.

Beginning May 2001, Denel manufacturing, under a USD3.6 million contract, main landing gear portion of lower centre-fuselage for Swedish Air Force Lot 3 Gripen combat aircraft, plus additional sections for the 28 Gripens ordered by the South African Air Force. Initial SWAF order is for 40 units, with options for a further 60. In third quarter of 2004, Denel began assembling first eight of 23 BAE Hawk Mk 120s for South African Air Force in a programme due for completion in mid-2006. In September 2004 it was also announced that Denel had received a USD2 million contract from BAE Systems to provide Hawk tooling to Hindustan Aeronautics Ltd for HAL's production of the 66 aircraft ordered by the Indian Air Force. Denel Aviation is sole-source supplier of tailplanes, flaps and airbrakes for all current production Hawk variants.

DENEL AH-2A ROOIVALK

English name: Red Kestrel

TYPE: Attack helicopter.

PROGRAMME: Considerably modified development of French SA 330 Puma. XDM and ADM prototypes reconfigured during 1995 with original Topaz engines replaced by more powerful Makila 1K2s with digital engine control, making first flight in this form June 1995. Contract for EDM prototype awarded in March 1994; more than 1,500 hours flown by XDM, ADM and EDM by December 1998. Airframe changes included modified IR exhaust suppression and intakes on XDM; fuselage construction unchanged on XDM and ADM.

Submitted (partnered by Marshall Aerospace) for British Army requirement in 1993-94, but subsequently eliminated. SAAF order for 12 signed in July 1996. First production Rooivalk (c/n 1001, SAAF serial number 670) left airframe jig 31 July 1997 and made first public flight 17 November 1998; handed over to SAAF on 17 November 1998 and joined No. 16 Squadron on 6 January 1999, formal acceptance being on 7 May 1999. Six delivered by June 2001 and all 12 by March 2004; trials at Test Flight Development Centre, Bredasdorp.

A commissioning order signed with the SAAF on 27 August 2003 provides for new functions in the communications system; addition of a missile approach warning system (MAWS); addition of the Mistral ATM; updates to HUMS and mission planning; and establishment of depot level repair capability. One development aircraft used for deck handling trials aboard support ship SAS *Drukenberg* in late 2002 and early 2003.

MoU with Airod of Malaysia provided for co-production in that country if ordered by Royal Malaysian Air Force. No RMAF order had materialised by end-2006, but influx of government funding earlier that year enabled Rooivalk to be entered in Turkish attack helicopter competition, for which it was short-listed with A129 Mangusta after elimination of Ka-52 and Tiger. Turkish requirement is for 30, with further 20 on option.

CURRENT VERSIONS: **AH-2A:** SAAF production version; at first known as CSH-2 but redesignated in 1998. First four aircraft delivered to Block 1A standard; Nos. 5-10 Block 1B; Nos. 11 and 12 Block 1E. Block 1A is basic aircraft with functional mechanical and



Rooivalk F2 cannon detail (James/Patrick Allen)

1196468

avionics systems; Block 1B added Topowl and Nightowl optical systems and night flying capability; Block 1E is definitive configuration, with fully operable helmet sight and weapon systems. Block 1A and 1B aircraft being updated to Block 1E standard; four so updated and two others in process by March 2003. First two Block 1E aircraft redelivered to No. 16 Squadron by September 2003 and fully operational with nine Block 1E aircraft by March 2004, remaining three then in retrofit for delivery later. Two Block 1E aircraft being used for further development purposes. Squadron carrying out OT&E on weapons system during 2004 and in exercises in 2006 as part of work-up to full day/night operational capability.

Description applies to EDM/production AH-2A except where indicated.

Maritime version: Projected version, shown as model at Farnborough Air Show, September 1998, though no commitment yet to build. Would have chin-mounted, 360° maritime search radar in place of undernose cannon; vision-enhancing E-O suite in nose; tailwheel moved forward 2 m (6.6 ft) to facilitate deck operations; flotation gear on forward sponsons and tailboom; manually operated blade folding; and enhanced ECM and communications systems. Shorter stub-wings would support four underwing Penguin or Exocet anti-ship missiles, plus tip-mounted AAMs for self-defence.

CUSTOMERS: South African Air Force, 12 ordered; possible longer-term requirement for up to 36. No. 16 Squadron reactivated 1 January 1999 at Bloemfontein AB as only squadron. Initial delivery 6 January 1999; deliveries originally scheduled at four per year until third quarter 2001 but protracted; total of 10 delivered by October 2002, with remaining two delivered by March 2004.

Intent to order eight reconfirmed by Malaysian Prime Minister in 1998, but not yet contracted (mid-2006); possible requirement for up to 24. Algeria, Australia, Singapore and Turkey have also expressed interest (named **RedHawk** for unsuccessful Australian Army bid), and ADM demonstrated to Saudi Arabia in August 1997, but no export orders up to end-2006, when candidate for Turkish Army order.

COSTS: According to September 2002 report, R&D costs were ZAR126 million, one-off restructuring costs ZAR124 million and production costs ZAR179 million; further ZAR305 million written off. Additional funding for ZAR661 million (USD81.2 million) early 2003 to complete full commissioning to Block 1E standard for service acceptance.

DESIGN FEATURES: Based on reverse engineering of SA 330 Puma dynamics system to Super Puma equivalent standard; engines moved aft to clear stepped tandem cockpits; rear drive taken inboard and forward to modified transmission. Nose-mounted target acquisition turret and chin-mounted gun; non-swept stub-wings for weapon carriage. With Makila 1K2 engines, four-blade fully articulating main rotor rotates at 267 to 290 rpm; five-blade, starboard-mounted tail rotor rotates at 1,290 rpm. Rotor brake fitted. Fixed leading-edge slat on horizontal stabiliser.

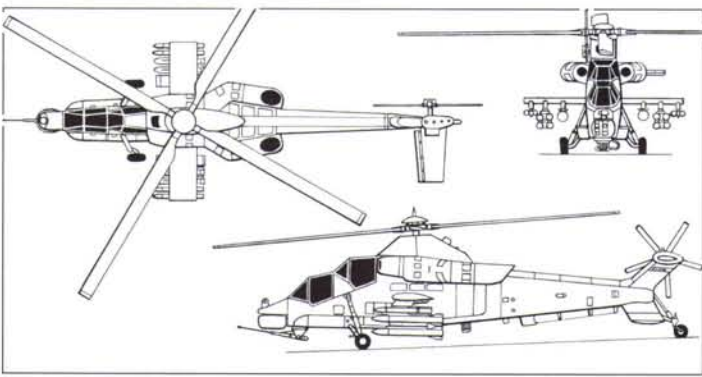
Low radar/visual/IR/acoustic signatures; optimised for NOE operation; NVG-compatible 'glass cockpit'; primary missions anti-armour and close air support; integrated digital nav/attack system.

FLYING CONTROLS: Duplex digital AFCS with automatic height hold, hover capture and hover hold; HOCAS (hands on collective and stick) controls.

STRUCTURE: Crash-resistant primary structure, of aluminium alloy, is of I-beam and monocoque construction; rotor blades and fuselage secondary structures of composites sandwich. Integral access ladders in fuselage; CFRP engine cowls form work platforms.

LANDING GEAR: Forward-mounted Messier-Dowty main gear with two-stage high-absorption main legs; fully castoring tailwheel at base of lower fin. Mainwheel tyres size 615x225-10. Gear designed to withstand landing impact of up to 6 m (20 ft)/s.

POWER PLANT: Two licence-built Turbomeca Makila 1K2 turboshafts, with digital control, each rated at 1,376 kW (1,845 shp) for T-O, 1,420 kW (1,904 shp) continuous power and 1,573 kW (2,109 shp) for 30 seconds emergency operation. Rear drive turned to drive forward into rear of transmission. Infra-red heat suppressors on exhausts; particle separators on intakes. Main gearbox mounted on vibration isolation system using tuned beam to isolate fuselage from rotor vibrations (said to have one of lowest vibration levels in its



Denel Rooivalk combat support helicopter (James Goulding)

0507637



AH-2A Rooivalk of No. 16 Squadron, South African Air Force (Janes/Patrick Allen)

1196478

class).

Transmission rated at 2,243 kW (3,008 shp) for T-O and 1,826 kW (2,449 shp) maximum continuous from both engines; single-engine transmission ratings are 1,715 kW (2,300 shp) maximum contingency and 1,491 kW (2,000 shp) maximum continuous.

Fuel tankage (self-sealing) in fuselage, under stub-wings (three 618 litre; 163.3 US gallon; 135.9 Imp gallon tanks for total of 1,854 litres; 489.8 US gallons; 407.8 Imp gallons). Pressure refuelling and defuelling. Provision for 750 litre (198 US gallon; 165 Imp gallon) drop tank on each inboard underwing station.

ACCOMMODATION: Pilot (rear) and co-pilot/weapons officer in stepped, tandem cockpits with Martin-Baker armoured, crashworthy seats and armour protection. Forward/downward view 23°. Access to cockpits via upward-opening gull-wing starboard side window panels. All transparencies flat-plate or single-curvature. Dual flight controls.

SYSTEMS: Environmental control system for cockpit air conditioning. Two independent hydraulic systems, each at 175 bar (2,538 lb/sq in) pressure; at 170 bar (2,465 lb/sq in), flow rate is 12 litres (3.2 US gallons; 2.6 Imp gallons)/min in starboard system and 27 litres (7.1 US gallons; 5.9 Imp gallons)/min in port system.

Electrical power from two 20 kVA alternators providing 200 V three-phase and 115 V single-phase AC at 400 Hz, with two transformer-rectifiers and two 24 V 31 Ah batteries for 28 V DC power. Full or partial electric de-icing/demisting optional.

Crew oxygen system, and fire detection and extinguishing systems, standard.

AVIONICS: All-digital, interfaced to dual-redundant mission computers and MIL-STD-1553B databusses; stores management system conforms to MIL-STD-1760A. Avionics integrator is ATE (Advanced Technologies and Engineering), supported by 15 subcontractors.

Comms: Frequency-agile transceivers: dual V/UHF (30 to 400 MHz) for normal use and single HF (2 to 30 MHz) for NOE flights; intercom/audio system; IFF transponder.

Flight: Duplex four-axis digital AFCS, incorporating (in EDM) dual Thales (Sextant) Stratus three-axis strapdown ring laser gyro AHRS, Sextant NSS 100-1 eight-channel GPS receiver, Doppler radar velocity sensor, J-band radar altimeter, heading sensor unit (two magnetometers), air data unit and omnidirectional airspeed sensor, all interfaced to two redundant navigation computers. Autopilot has one-touch autohover and attitude hold. Nav/attack system programmed by preloaded cartridge; can hold up to five flight plans (100 waypoints), which can be edited in flight by either crew member.

Instrumentation: Integrated flight management system, with (in EDM) two 160 × 160 mm (6.3 × 6.3 in) Thales (Sextant) MFD 66 liquid crystal colour MFDs, two Sextant Topowl helmet-mounted sights/displays, and a position management system in each cockpit. Both cockpits have a back-up basic instrument panel for 'get home' capability in the event of computer or power failure. MFDs show flight control, navigation (including moving map on pilot's display), threat warning/EW, fire/weapons control and TDATS imagery, and can copy to each other. Cockpit instruments compatible with NVGs.

Mission: Nose-mounted, gyro-stabilised turret contains target detection, acquisition and tracking system (TDATS) incorporating a three fields of view TV and FLIR with automatic guidance and tracking, an LLTV camera and a laser range-finder; associated equipment includes crew members' Thales (Sextant) helmet sights, missile command link and tracking goniometer. Helmet sights display both flight and weapon data, and can cue both the TDATS turret and the gun turret. Denel Optronics and Thales (Pilkington Optronics) PNVs (Pilot Night Vision Sensor), a two-axis turret with 40 × 30° field of view FLIR, offered as export alternative to Sextant helmet sights.

Self-defence: Optimised ECM can include radar and laser warning receivers, chaff/flare dispensers and RF, IR and laser jammers.

ARMAMENT: Long- or short-barrel version of 20 mm Armscor F2; cleared also for 30 mm weapon. F2 has 750 rounds of ammunition, firing rate of 740 rds/min, and slew rate of 90°/s. Gun linked to TDATS and helmet-mounted sight display (HMSD). Three underwing stores stations each side. Two or four M159 19-tube launchers for Forges de Zeebrugge FZ90 70 mm unguided rockets and/or four-round launchers for up to 16 Mokopa ZT-6 anti-tank

missiles (semi-active laser or MMW version) on inner four underwing pylons; two or four Mistral IR air-to-air missiles on outboard pylons.

DIMENSIONS, EXTERNAL:

Main rotor diameter	15.58 m (51 ft 1½ in)
Tail rotor diameter	3.05 m (10 ft 0 in)
Length: fuselage, excl gun, tail rotor turning	16.39 m (53 ft 9¼ in)
overall, rotors turning	18.73 m (61 ft 5½ in)
Wing span (to c/l of AAM pylons)	6.355 m (20 ft 10¼ in)
Fuselage:	
Max width (excl engine fairings)	1.28 m (4 ft 2½ in)
Max depth (belly to top of rotor head)	4.00 m (13 ft 1½ in)
Height: over tail rotor	4.445 m (14 ft 7 in)
to top of rotor head	4.59 m (15 ft 0¼ in)
overall	5.185 m (17 ft 0¼ in)
Wheel track	2.78 m (9 ft 1½ in)
Wheelbase	11.77 m (38 ft 7½ in)

AREAS:

Main rotor disc	190.60 m ² (2,052.1 sq ft)
Tail rotor disc	7.27 m ² (78.23 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	5,910 kg (13,029 lb)
Max internal fuel weight	1,469 kg (3,238 lb)
External weapons load with full internal fuel	1,563 kg (3,446 lb)
Max external load (with 1,000 kg; 2,205 lb fuel)	2,032 kg (4,480 lb)
Typical mission T-O weight	7,500 kg (16,535 lb)
Max T-O weight	8,750 kg (19,290 lb)
Max disc loading	45.9 kg/m ² (9.40 lb/sq ft)
Transmission loading at max T-O weight and power (Makila 1K2)	3.90 kg/kW (6.41 lb/shp)

PERFORMANCE (at 7,500 kg; 16,535 lb combat weight, except where indicated. A: ISA at S/L, B: ISA + 27° C at 1,525 m; 5,000 ft):

Never-exceed speed (VNE): A, B	167 kt (309 km/h; 192 mph)
Max cruising speed: A	150 kt (278 km/h; 173 mph)
B	130 kt (241 km/h; 150 mph)
Max sideways speed: A	50 kt (93 km/h; 58 mph)
Max rate of climb at S/L: A	799 m (2,620 ft)/min
B	760 m (2,493 ft)/min
Rate of climb at S/L, OEI: A	344 m (1,128 ft)/min
Service ceiling: A	6,100 m (20,000 ft)
B	5,150 m (16,900 ft)
Hovering ceiling IGE: A	5,850 m (19,200 ft)
B	3,110 m (10,200 ft)
Hovering ceiling OGE: A	5,455 m (17,900 ft)
B	2,410 m (7,900 ft)
Excess hover power margin OGE, S/L anti-tank mission	+25%
Range with max internal fuel, no reserves: A	380 n miles (704 km; 437 miles)
B	507 n miles (940 km; 584 miles)
Range at max T-O weight with external fuel: A	680 n miles (1,260 km; 783 miles)
B	720 n miles (1,335 km; 829 miles)
Endurance with max internal fuel, no reserves: A	3 h 36 min
B	4 h 55 min
Endurance at max T-O weight with external fuel: A	6 h 52 min
B	7 h 22 min
g limits	+2.6/-0.5

RAVIN

RAVIN COMPOSITE AIRCRAFT MANUFACTURES

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DIRECTORS:
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Ravin's first product is the all-composite Ravin 500, based on the PA-24 Comanche. US marketing is by Ravin Aircraft USA, which received first kits for sale in December 2005.

RAVIN RAVIN 500

TYPE: Four-seat kitbuilt.
PROGRAMME: Transformation of Piper PA-24 Comanche (first flown 24 May 1956) into composites. Design and development took two years and five months. Project originated during Jan Troskie's ownership of a Comanche 260C and following joint construction of Tri-R KIS composites kitplane with Leon Joubert, who later designed Ravin's avionics suite.
Prototype ZU-CTW first flown 15 September 2002; further aircraft (ZU-DCT) first flown 13 September 2003. Also available as complete aircraft. US marketing began in 2006 upon arrival of kit No. 9.
CUSTOMERS: Total of nine flying in South Africa by April 2006.
COSTS: Kit USD89,865 plus tax, excluding engine, propeller and avionics (2006).
DESIGN FEATURES: Based on Piper Comanche, but some 7 per cent (non-uniform) smaller and with redesign to enhance aerodynamics (wing profile), drag reduction (engine cowling), occupant's comfort and operating costs. Original Fowler flaps replaced by plain units; horizontal tail surfaces changed to conventional tailplane and elevator.
Can be equipped with standard Comanche engine, engine mount, propeller, landing gear, flight control systems, avionics and instruments or with more modern equivalents.
Airframe compatible with conversion to PA-30 Twin Comanche.
Kit version quoted build time 500 hours.
FLYING CONTROLS: Conventional and manual. Single-piece, balanced elevator with flight-adjustable tab, starboard. Horn-balanced rudder with flight-adjustable tab. Actuation (including flaps) by cables. Plain flaps.
STRUCTURE: Composites throughout. Carbon fibre wing spar; metal engine mounting attached to long stringers to distribute loads along fuselage. Bonded windows.
LANDING GEAR: Tricycle type; retractable. Hydraulic actuation; mainwheels retract inwards, legs being covered by doors, but wheels exposed; nosewheel retracts rearward. Main tyres 6.00-6; nose 5.00-5.
POWER PLANT: One 194 kW (260 hp) Textron Lycoming IO-540 flat-six. Fuel in two wing tanks, combined capacity 606 litres (160 US gallons; 133 Imp gallons).



Ravin 500 four-seat composites lightplane 1158014

ACCOMMODATION: Four persons in tandem side-by-side pairs. Forward-hinged cabin door port, front. Hat shelf. Top-hinged baggage hold door starboard, rear.
DIMENSIONS, EXTERNAL:
Wing span 10.40 m (34 ft 1½ in)
Wing aspect ratio 7.4
Length overall 7.42 m (24 ft 4 in)
AREAS:
Wings, gross 14.60 m² (157.2 sq ft)
WEIGHTS AND LOADINGS:
Weight empty 850 kg (1,874 lb)
Max T-O weight 1,620 kg (3,571 lb)
Max wing loading 111.0 kg/m² (22.73 lb/sq ft)
Max power loading 8.36 kg/kW (13.73 lb/hp)
PERFORMANCE:
Never-exceed speed (VNE) 243 kt (450 km/h; 280 mph)
Max level speed 205 kt (380 km/h; 236 mph) IAS
Cruising speed at 75% power:
S/L 185 kt (342 km/h; 213 mph) IAS
at FL65 196 kt (363 km/h; 226 mph)
Stalling speed: clean 64 kt (119 km/h; 74 mph) IAS
flaps and gear down 56 kt (104 km/h; 65 mph) IAS
Max rate of climb at S/L 457 m (1,500 ft)/min
Range with 10% reserves 1,950 n miles (3,611 km; 2,244 miles)

WHISPER

WHISPER AIRCRAFT

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Web: www.whisperaircraft.com
DESIGNER: Russell L Phillips

Whisper motor glider manufacture was transferred to Jabiru South Africa in 2006 in order to meet demand.

WHISPER WHISPER

TYPE: Motor glider.
PROGRAMME: Prototype Phillips Whisper registered ZS-GXW in September 2003; public debut at Port Elizabeth Air Show October 2004.
CUSTOMERS: Total of 47 kits delivered by late 2006, when 48th supplied to Jabiru SA as first to be built by this company. Six had received South African airworthiness certificates by September 2006.
DESIGN FEATURES: Low, trapezoidal wing; cruciform empennage with trapezoidal surfaces. Quoted build time 1,000 hours for basic kit, including builder's fabrication of some parts; fast-built kit 500 hours.
FLYING CONTROLS: Conventional and manual.
STRUCTURE: Composites throughout, except steel reinforcement for landing gear attachment; birch ply; and stainless steel firewall and engine mount.
LANDING GEAR: Tailwheel type; fixed. Speed fairings over all wheels.
POWER PLANT: One 59.0 kW (79.1 hp) Limbach L 2000 flat four driving a two-blade Hoffmann three-position propeller. Alternatively, Aero Vee or similar Volkswagen-based engine; Jabiru and Rotax alternatives being developed. Fuel capacity 85 litres (22.5 US gallons; 18.7 Imp gallons).
ACCOMMODATION: Two persons, side by side, beneath single-piece canopy/windscreen.
DIMENSIONS, EXTERNAL:
Wing span 16.00 m (52 ft 6 in)
Wing aspect ratio 17.1
Length overall 7.16 m (23 ft 6 in)
AREAS:
Wings, gross 15.00 m² (161.5 sq ft)



Prototype Whisper motor glider with Limbach engine 1158842

WEIGHTS AND LOADINGS:
Weight empty 500 kg (1,102 lb)
Max T-O weight 745 kg (1,642 lb)
Max wing loading 49.7 kg/m² (10.17 lb/sq ft)
Max power loading 12.63 kg/kW (20.75 lb/hp)
PERFORMANCE:
Never-exceed speed (VNE) 135 kt (250 km/h; 155 mph)
Max level speed 100 kt (185 km/h; 115 mph)
Cruising speed at 75% power 90 kt (167 km/h; 104 mph)
Max rate of climb at S/L 213 m (700 ft)/min
T-O run 200 m (660 ft)
Range 648 n miles (1,200 km; 745 miles)
PERFORMANCE UNPOWERED:
Stalling speed 39 kt (72 km/h; 45 mph)
Best glide ratio at 57 kt (105 km/h; 65 mph) 28
Min rate of sink at 43 kt (80 km/h; 50 mph) 0.90 m (2.95 ft)/s

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PRESIDENT: Pedro Esteban Poverda

MANAGER: Carlos Figuero Cano

AeroCopter showed the first production Futura autogyro at the Aero '03 exhibition at Friedrichshafen, Germany, in April 2003 and is now pursuing an Ultralight category version. The company employs a workforce of eight in its 800 m² (8,611 sq ft) factory.

AEROCOPTER FUTURA

TYPE: Two-seat autogyro/ultralight.

PROGRAMME: Design began in 1998; two technology demonstrators; two prototypes flown in 2002. Initial production aircraft (unregistered; black colour scheme) flew immediately after debut at Friedrichshafen, Germany, in April 2003. Second production aircraft, incorporating detail changes including cantilever spring main landing gear (unregistered; red colour scheme) exhibited at Blois, France, in September 2004. Third aircraft (blue scheme) first in Ultralight configuration, lacking full metal chassis.

CURRENT VERSIONS: **Light:** Ultralight version. Available in Heavy-Duty, Comfort or Luxe equipment standards.

Standard: Experimental category version. Above three standards, plus Royal and Select. COSTS: Light EUR59,000; Standard EUR60,000; Standard Luxe EUR72,050 all flyaway (2006).

DESIGN FEATURES: Objectives were "spectacular and aggressive" appearance, combined with latest technology and high level of standard equipment. Twin-tailboom configuration with



AeroCopter Futura second prototype (Paul Jackson)

1129244

enclosed cabin; tailbooms and main landing gear mounted on anhedral aerofoil-shape fairings. Main rotor pre-rotation by Bowden cable. Rotor brake. An 'F-16 style' air intake replaced upper air intake on initial production aircraft and fairing added to rotor mast.

FLYING CONTROLS: Twin rudders, plus all-moving central fin, actuated by Bowden cables.

STRUCTURE: Generally of composites and glass fibre, with chrome-molybdenum tube framework. Main rotors designed and manufactured by ASII in US, but Ultralight has AeroCopter extruded aluminium rotors and tube frame restricted to cockpit area. Forward fuselage and glazing based on Rotorway Exec helicopter.

LANDING GEAR: Tricycle type; fixed. Mainwheels 400x100; nosewheel 4.00-6. Hydraulic disc brakes on mainwheels. Steerable faired-in nosewheel directly linked to rudder. Wheel guards on main wheels.

POWER PLANT: One 84.6 kW (113.4 hp) Rotax 914 flat-four driving a KievProp three-blade pusher propeller via a reduction drive including a centrifugal clutch. Optionally, 104 kW (140 hp) Subaru EA-81.

EQUIPMENT: Optional ballistic recovery parachute.

DIMENSIONS, EXTERNAL:

Main rotor diameter	8.53 m (28 ft 0 in)
Width overall	2.10 m (6 ft 10 3/4 in)
Length of fuselage	4.20 m (13 ft 9 1/4 in)
Height overall	3.20 m (10 ft 6 in)

AREAS:

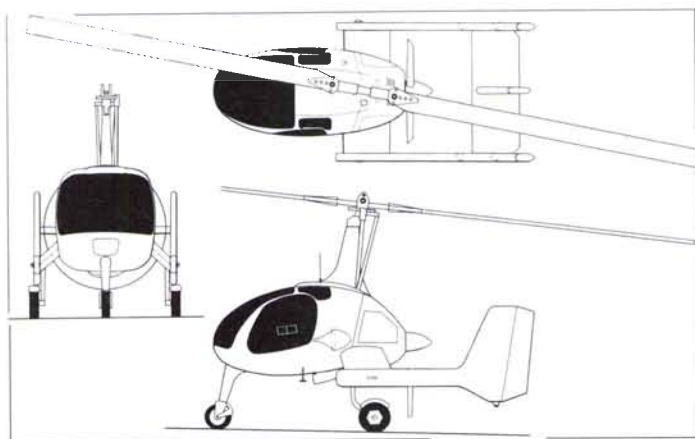
Rotor disc	56.74 m ² (610.7 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	275 kg (606 lb)
Max T-O weight: Light	450 kg (992 lb)
Light with parachute	472.5 kg (1,041 lb)
Standard	500 kg (1,102 lb)

PERFORMANCE:

Max level speed	103 kt (190 km/h; 118 mph)
Normal cruising speed	86 kt (160 km/h; 99 mph)
Minimum speed	22 kt (40 km/h; 25 mph)
T-O run	100 m (330 ft)
Landing run	5 m (20 ft)
Endurance	4 h



AeroCopter Futura two-seat autogyro in revised form (Paul Jackson)

0589201

AEROMORAGÓN

AEROMORAGÓN SI

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PRESIDENT: Diego Chaves

Following production of some 30 Moragón M-1s, Aeromoragón has launched the improved Stela.

AEROMORAGÓN STELA

TYPE: Side-by-side ultralight.

PROGRAMME: Prototype, converted from M-1 prototype EC-EA4, shown at RSA Rally, Blois, France, in 2005.

COSTS: EUR42,000 with Jabiru engine and basic instruments (2006). Kit prices on application.

DESIGN FEATURES: High-mounted, constant-chord wing with single streamlined bracing strut each side; low, cantilever tailplane; sweptback fin.

FLYING CONTROLS: Conventional and manual. Actuation by pushrods (ailerons, elevator) and cables (rudder). Electrically actuated flaps.

STRUCTURE: Fuselage frame of 6061T6 and 2024T3 aluminium tube with carbon fibre outer shell, including integral fin and tailplane. Wing of conventional spars and ribs, with carbon fibre skin.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted, spring cantilever, carbon fibre V tube mainwheel legs; trailing link nosewheel. Lever-actuated mainwheel brakes for steering. Wheel fairings standard.

POWER PLANT: One 59.7 kW (80 hp) Jabiru 2200 flat-four driving a GT 58/38 three-blade carbon fibre propeller. Options of 58.8 kW (78.9 hp) Jabiru 912 UL; 63.4 kW (85 hp) Verner; and 73.5 kW (98.6 hp) Rotax 912 UL.



Aeromoragón Stela two-seat ultralight

1037964

EQUIPMENT: Optional ballistic recovery parachute.

DIMENSIONS, EXTERNAL:

Wing span	9.60 m (31 ft 6 in)
Length overall	6.00 m (19 ft 8 1/4 in)
Height overall	2.47 m (8 ft 1 1/4 in)

AREAS:

Wings, gross	12.04 m ² (129.6 sq ft)
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WEIGHTS AND LOADINGS (Jabiru engine):

Weight empty	260 kg (573 lb)
Max T-O weight	450 kg (992 lb)

PERFORMANCE:

Max cruising speed	94 kt (175 km/h; 109 mph)
Stalling speed	33 kt (60 km/h; 38 mph)
Endurance	5 h

CAG

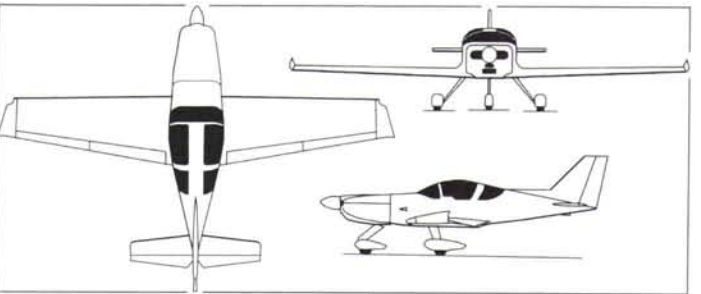
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PRESIDENT: Antonio Castelo Silvira

Formed in 1996, CAG operates from two sites: prototype work is performed at its 1,500 m² (16,150 sq ft) factory at Ribadeo, with series production undertaken in a new, purpose-built 5,000 m² (53,825 sq ft) facility at Villanueva de Gállego, Zaragoza, opened in 2005. A July 2003 agreement with Mooney has lapsed.

CAG TOXO

English name: Gorse Bush
TYPE: Two-seat lightplane; side-by-side ultralight kitbuilt.
PROGRAMME: Designed by José Luis Miro. Original Toxo (EC-YYU) flew in 2000, followed by second prototype (EC-YYV); Toxo II (EC-ZFB) followed in September 2001. Toxo Sportster, Cruiser and Trainer announced in 2005; however, Sportster is lead product.
CURRENT VERSIONS: **Toxo:** Ultralight; approved in France and Spain; similar registration under way in Austria, Germany and Netherlands in 2003. Typically 59.7 kW (80 hp) Jabiru 2200 flat-four engine and Duc fixed-pitch propeller. Fuel capacity 60 litres (15.9 US gallons; 13.2 Imp gallons). MTOW limited to 472.5 kg (1,041 lb).
Toxo II: VLA category, broadly similar to Sportster.
Toxo IV: Proposed four-seat version; in abeyance.
Toxo Trainer: Announced 2005; meets LSA (Light Sport Aircraft) regulations and 51 per cent homebuilt rules; renamed Sportster SLSA, first sales were due spring 2006.
Toxo Cruiser: Announced 2005; available as a kit or ready to fly; meets primary VLA requirements.
Toxo Sportster: Public debut at EAA Air Venture '05, Oshkosh; available as kit only.
CUSTOMERS: Total 23 delivered by early 2006 to customers in Brazil, France, Germany, Portugal, Spain and the United States.
COSTS: VLA EUR89,477 (2003) excluding tax, complete; VLA kit EUR54,458 (2003) including Jabiru 3300 engine, excluding tax; SLSA EUR99,792 flyaway (2006).
DESIGN FEATURES: Experimental/VLA or Ultralight category; engines between 59.7 and 134 kW (80 and 180 hp). Wide speed range and high aerodynamic efficiency, including short field performance and good stability. Streamlined, tapered low-wing design with sweptback fin and upturned wingtips.
FLYING CONTROLS: Conventional and manual. Pushrod actuation. Fowler slotted flaps. Variable incidence (electrical) tailplane for trimming. (Horn-balanced elevators and alternative all-moving tailplane of prototypes replaced by mass-balanced elevators for production Toxo II).
STRUCTURE: Mainly of vacuum-bonded glass fibre and honeycomb; aluminium and steel fittings. Wing has T-beam composites spar and integral fuel tanks.
LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring cantilever mainwheel legs with wheel fairings. Steerable, trailing link nosewheel with wheel fairing. Mainwheels size 5.00. Brakes and parking brake.
POWER PLANT: Earlier versions had engines to meet customer's requirements. Typically 89 kW (120 hp) Jabiru 3300 driving a Warp Drive Airmaster three-blade, constant-speed propeller. Cruiser Sportster and Sportster SLSA all have 73.5 kW (98.6 hp) Rotax 912 ULS driving an Airmaster or MT-Propeller three-blade propeller. Usable fuel 79 litres (21.0 US gallons; 17.5 Imp gallons) in Sportster SLSA and Cruiser; 151 litres (40.0 US gallons; 33.3 Imp gallons) in Sportster.
ACCOMMODATION: Two persons, side by side, each with centreline-hinged, upward-opening door; separate windscreen; baggage space to rear of seats; rear window each side. Dual controls. Cockpit heated and ventilated.
AVIONICS: *Comms:* Optional Becker AR-4201 radio, Zennheiser intercom and Becker ATC 4401-175 Mode S transponder.
Flight: Optional Bendix/King moving map display.



CAG Toxo II (Jabiru 2200 flat-four) (Paul Jackson) 0589200



CAG Toxo II prototype 1159725

EQUIPMENT: Optional ballistic parachute.

DIMENSIONS, EXTERNAL:

Wing span: Cruiser	8.70 m (28 ft 6½ in)
Sportster	7.69 m (26 ft 1¼ in)
Sportster SLSA	10.70 m (35 ft 1¼ in)
Wing chord, mean: Cruiser, Sportster SLSA	1.20 m (3 ft 11¼ in)
Sportster	1.10 m (3 ft 7¼ in)
Length overall: Cruiser, Sportster SLSA	6.00 m (19 ft 8¼ in)
Sportster	5.40 m (17 ft 8½ in)
Height overall: Cruiser, Sportster SLSA	2.12 m (6 ft 11½ in)
Sportster	2.00 m (6 ft 6¾ in)

DIMENSIONS, INTERNAL:

Cabin max width: Cruiser	1.23 m (4 ft 0½ in)
Sportster	1.05 m (3 ft 5¼ in)
Sportster SLSA	1.07 m (3 ft 6 in)

AREAS:

Wings, gross: Cruiser	10.40 m² (111.9 sq ft)
Sportster	8.70 m² (93.7 sq ft)
Sportster SLSA	12.78 m² (137.6 sq ft)

WEIGHTS AND LOADINGS:

Weight empty: Cruiser, Sportster SLSA	379 kg (836 lb)
Sportster	399 kg (880 lb)
Max baggage weight: Cruiser, Sportster SLSA	22 kg (50 lb)
Sportster	32 kg (70 lb)
Max T-O weight: Cruiser	658 kg (1,452 lb)
Sportster	698 kg (1,540 lb)
Sportster SLSA	598 kg (1,320 lb)
Max wing loading: Cruiser	63.4 kg/m² (12.98 lb/sq ft)
Sportster	80.3 kg/m² (16.44 lb/sq ft)
Sportster SLSA	46.9 kg/m² (9.60 lb/sq ft)
Max power loading: Cruiser	8.96 kg/kW (14.73 lb/hp)
Sportster	9.51 kg/kW (15.62 lb/hp)
Sportster SLSA	8.15 kg/kW (13.39 lb/hp)

PERFORMANCE:

Never-exceed speed (VNE): Cruiser	165 kt (305 km/h; 190 mph)
Sportster SLSA	170 kt (314 km/h; 195 mph)
Sportster	217 kt (402 km/h; 250 mph)
Max operating speed: Cruiser	152 kt (282 km/h; 175 mph)
Sportster	200 kt (370 km/h; 230 mph)
Sportster SLSA	120 kt (222 km/h; 138 mph)
Normal cruising speed: Cruiser	135 kt (249 km/h; 155 mph)
Sportster	148 kt (274 km/h; 170 mph)
Sportster SLSA	104 kt (193 km/h; 120 mph)
Stalling speed: flaps up: Cruiser	57 kt (104 km/h; 65 mph)
Sportster	59 kt (107 km/h; 67 mph)
Sportster SLSA	40 kt (73 km/h; 45 mph)
flaps down: Cruiser	46 kt (84 km/h; 52 mph)
Sportster	51 kt (94 km/h; 58 mph)
Max rate of climb at S/L: Cruiser	335 m (1,100 ft)/min
Sportster	457 m (1,500 ft)/min
Sportster SLSA	305 m (1,000 ft)/min
Service ceiling: all	4,115 m (13,500 ft)
T-O run: Cruiser	142 m (465 ft)
Sportster	154 m (505 ft)
Sportster SLSA	122 m (400 ft)
Landing run: Cruiser	181 m (595 ft)
Sportster	184 m (605 ft)
Sportster SLSA	177 m (580 ft)
Range: Cruiser	730 n miles (1,352 km; 840 miles)
Sportster	1,510 n miles (2,796 km; 1,737 miles)
Sportster SLSA	645 n miles (1,194 km; 742 miles)
Endurance: Cruiser, Sportster SLSA	6 h 0 min
Sportster	10 h 0 min
g limits: Cruiser, Sportster SLSA	+5/-3
Sportster	+6/-4

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Web: www.lsa-aero.com
PRESIDENT: Don Langford

Company formed 11 November 1995 to develop and market Martin 3 lightplane as landplane, seaplane flying-boat. Manufacture is in 1,300 m² (14,000 sq ft) workshop at Portonovo.

COLYAE MARTIN 3

TYPE: Side-by-side ultralight.
PROGRAMME: Developed from basic design of Canelas Ranger, produced in 1983 by Martín Uña Lima and manufactured in small numbers. Prototype was flying-boat; second was landplane. Following formation of Colyaer company, third prototype built and design information computerised for production.
CURRENT VERSIONS: **M3-S100:** Motor glider; greater wing area.
M3-S110: Shorter span (10.40 m; 34 ft 1½ in); higher cruising speed.



Colyaer Martin 3 US demonstrator 1159727

Gannet: Seaplane; described separately.
Freedom: Amphibian; described with Gannet.
DESIGN FEATURES: Intended to provide side-by-side seating for two, good outward visibility, spacious cockpit, 108 kt (200 km/h; 124 mph) cruising speed. Ultralight or JAR-VLA compatibility, range of 809 n miles (1,500 km; 932 miles), composites construction and competitive price.
High wing, without bracing struts, mounted on pod-and-boom fuselage, with T tail. Engine and pusher propeller mounted behind cockpit.
Wing section NACA 643-618.
FLYING CONTROLS: Conventional and manual. Electrically operated flaps, max deflections -7° for long-distance cruises; +50° for short landing.
STRUCTURE: Composites throughout. Carbon and glass fibre cantilever mainwheel legs; Kevlar, Nomex and epoxy resins.
LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring cantilever mainwheel legs with wheel fairings. Trailing-link nosewheel with wheel fairing.
POWER PLANT: Suitable engines between 45 and 75 kW (60 and 100 hp). Standard fuel capacity 40 litres (10.6 US gallons; 8.8 Imp gallons). Two optional tanks increase capacity to 90 litres (23.8 US gallons; 19.8 Imp gallons) of which 89 litres (23.5 US gallons; 19.6 Imp gallons) are usable, or 138 litres (36.5 US gallons; 30.4 Imp gallons) of which 130 litres (34.3 US gallons; 28.6 Imp gallons) are usable.
DIMENSIONS, EXTERNAL:
Wing span 12.37 m (40 ft 7 in)
Length overall 5.85 m (19 ft 2 1/4 in)
DIMENSIONS, INTERNAL:
Cockpit max width 1.10 m (3 ft 7 1/4 in)
AREAS:
Wings, gross: S100 12.00 m² (129.2 sq ft)
S110 10.50 m² (113.0 sq ft)



Colyaer Gannet demonstrating in US (Paul Jackson) 1159747

EADS CASA

CONSTRUCCIONES AERONAUTICAS SA (MILITARY TRANSPORT AIRCRAFT DIVISION OF EADS)
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PRESIDENT AND CEO: Francisco Fernández Sáinz
HEADS OF DIVISION:
Francisco Fernández Sáinz (Military Transport Aircraft)
Pablo de Bergia (Military Aircraft)
Pedro Méndez (Space)
DIRECTOR, COMMERCIAL COMMUNICATIONS: Miguel Sánchez

WEIGHTS AND LOADINGS:	
Weight empty	280 kg (617 lb)
Max T-O weight	599 kg (1,320 lb)
PERFORMANCE, POWERED:	
Max level speed: S100	97 kt (180 km/h; 112 mph)
S110	108 kt (200 km/h; 124 mph)
Stalling speed: both	36 kt (65 km/h; 41 mph)
Max rate of climb at S/L:	
S100	300 m (984 ft)/min
S110	240 m (787 ft)/min
T-O and landing run: S100	120 m (395 ft)
S110	140 m (460 ft)
Range with max optional fuel	809 n miles (1,500 km; 932 miles)
g limits	+6/-4
PERFORMANCE, UNPOWERED:	
Stalling speed	36 kt (65 km/h; 41 mph)
Best glide ratio: S100	23
S110	17
Min rate of sink: S100	1.2 m (3.9 ft)/s
S110	1.5 m (4.9 ft)/s

COLYAER GANNET and FREEDOM

TYPE: Two-seat flying boat kitbuilt.
PROGRAMME: Derivation of Martin 3. Prototype completed in early 2003 and registered EC-ZJU; initially known as Mascato.
CURRENT VERSIONS: **Freedom:** Amphibian version.
Gannet: Flying boat version; has redesigned hull when compared to Freedom. US demonstrator has upturned tips to tailplane; LSA compliant.
CUSTOMERS: Around 40 examples sold worldwide by early 2006.
COSTS: Gannet USD71,820 (2005); Freedom USD117,406 flyaway (2006).
FLYING CONTROLS: Flap angle -5° for cruising; maximum deflection 50° for emergency landings.
STRUCTURE: Generally of glass fibre, carbon fibre and Kevlar, with some metal items. Fuselage divided into three watertight compartments.
LANDING GEAR: Freedom: Single-step hull with outrigger floats at two-thirds' span. Wheels retract totally under electrical power; steerable nosewheel; hydraulic brakes. Max wave height 30 cm (1 ft). Water rudder.
DIMENSIONS, EXTERNAL:
As Martin 3 S100
DIMENSIONS, INTERNAL:
Cockpit: Max width 1.22 m (4 ft 0 in)
Height 1.12 m (3 ft 8 in)
AREAS:
As Martin 3 S100
WEIGHTS AND LOADINGS: As Martin 3 S100, except:
Weight empty: Freedom 287 kg (632 lb)
Gannet 324 kg (714 lb)
Max T-O weight: both 648 kg (1,430 lb)
PERFORMANCE, POWERED: As Martin 3 S100, except:
T-O run, water, both 140 m (460 ft)
Landing run, Gannet 140 m (460 ft)
Landing run, land: Freedom 121 m (395 ft)
PERFORMANCE, UNPOWERED:
Best glide ratio 20
Min rate of sink 1.5 m (4.9 ft)/s

CASA, founded in 1923 to build French Breguet XIXs under licence for Spain's military aviation arm, was owned 99.2852 per cent by the Spanish state holding company Sociedad Estatal de Participaciones Industriales (SEPI), 0.7098 per cent by DASA (Germany) and 0.005 per cent by others. It was announced on 11 June 1999 that SEPI and DaimlerChrysler had signed an MoU to unite CASA and DASA in a new single company. This company was subsequently created as EADS by Aerospatiale Matra and DaimlerChrysler Aerospace and joined by CASA as a founder member on 2 December 1999. As a result, EADS CASA was restructured. In October 2001, the company acquired a 41 per cent holding in PZL Warszawa-Okęcie. A 5 per cent share in Eurocopter, and thence a 40 per cent stake in the newly formed Eurocopter España, was established in late 2003; latter company responsible initially for final assembly of 24 Eurocopter Tigers for Spanish Army.

Military Transport Aircraft Division

This division is the Military Transport Aircraft Division of EADS and is responsible for the design, manufacture and marketing of light and medium transport aircraft such as the C-212, CN-235 and C-295. Some structural components for the CN-235 and C-295 are now manufactured by ENAER of Chile, under an eight-year co-operation agreement signed on 21 June 2001.

EADS CASA has been designing and manufacturing light and medium military transport aircraft for over 30 years for such roles as paratroop drops, aerial delivery, medevac, logistic transport or maritime patrol. These aircraft have seen service in more than 50 countries. Its former Airbus Division was fully responsible for design, development and manufacture of diverse structural parts integrated into all Airbus aircraft, having specialised in horizontal stabilisers, as well as in components manufactured in carbon fibre. The latter capability enables it to play an essential role within construction of the A380 megaliner, in which EADS participates with an 80 per cent stake. EADS CASA is the subcontractor responsible for designing and producing a tanker conversion kit for four Airbus A310MRTTs ordered by the German Air Force; is leading the A330MRTT air tanker consortium bidding for the UK Future Strategic Tanker Aircraft (FSTA) requirement; and in November 2001 launched a development programme for an advanced air refuelling boom system (ARBS) with fly-by-wire control. Phase 1 flight testing of ARBS, on an A310 testbed, took place 16 to 30 March 2006.

It also leads the future A400M heavy military transport aircraft programme, managed by Airbus Military Company in which EADS has a major stake. The A400M has been designed according to the shared requirements of seven air forces, and as a European reply to the replacement of current military transport aircraft such as the C-130 Hercules and C.160 Transall.

The division offers its FITS (Fully Integrated Tactical System) for diverse applications such as maritime patrol and surveillance, or anti-submarine/anti-surface warfare. First recipient of FITS was Spanish Air Force P-3B fleet (first of five upgraded aircraft rolled out early May 2003); selected also by Brazilian Air Force to retrofit nine P-3As.

A new factory was inaugurated at Bahía de Cádiz on 2 July 2003. Replacing the older facility at Puntales, it has a total area of 78,840 m² (848,625 sq ft), including 20,056 m² (215,880 sq ft) of covered accommodation.

Military Aircraft Division

Military Aircraft Division is a 43 per cent partner within the Eurofighter consortium, being fully responsible for engineering, structural tests and systems, as well as integrated logistic support, manufacture and prototype flight tests. It is currently in the development stage.

For series production Eurofighters, it manufactures starboard wings as well as port and starboard slats for every aircraft. Final assembly of all aircraft ordered by the Spanish Air Force is also carried out by EADS CASA.

EADS CASA has more than 40 years of experience working with military and commercial operators in areas of maintenance, overhaul and modernisation of aircraft and helicopters. Recently developed modernisation programmes for Spanish Air Force F-5, C-130 Hercules and Mirage F1 fleets are offered to other countries. Modernisation programmes concerning F-18 and F-5 avionics are under way.

Space Division

This division develops structural, thermal and power distribution subsystems for launchers, satellites and orbital infrastructures. It also takes part in military satellite and mini-satellite programmes for the Spanish MoD and participates in the programmes for the development of new technologies, both in Spain and abroad.

CASA C-212 SERIES 400

US military designation (Series 200): C-41A

TYPE: Twin-turboprop transport.

PROGRAMME: Design studies for C-212 began 1964; design accepted by Spanish Air Force 1967; two prototypes (plus one static test) ordered 24 September 1968; first flights 26 March and 23 October 1971. Series 100 and 200 no longer produced, but four Series 200 in service with US Special Operations Forces belatedly allocated C-41A designation in 2002. Series 300 certified to FAR Pts 25, 121 and 135 in December 1987 but no longer offered; replaced by Series 400 from 1998. Former name Aviocar now discontinued.

CURRENT VERSIONS: **100:** Initial version; 158 built (CASA two prototypes plus 128, IPTN 28 from Spanish CKD kits).

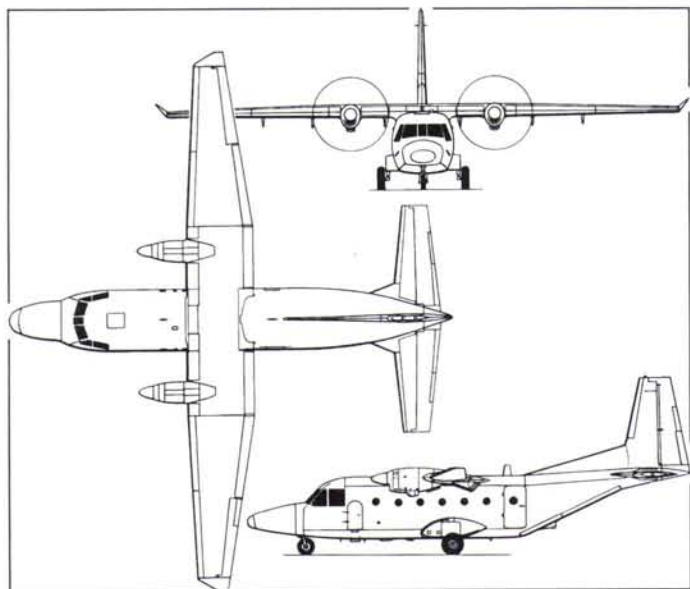
200: Succeeded Srs 100 from 1980; 151 built by CASA. Final examples (three for Indonesian Navy) reportedly nearing completion by Dirgantara in February 2006.

300: Differed from Series 200 in having winglets to improve climb performance; enlarged nose for increased payload; and enhanced cruise performance; 52 built.

400: Initiated mid-1995, but not formally launched until June 1997 (Paris Air Show), following first flight (EC-212) on 4 April that year. EFIS and re-rated TPE331-12JR engines maintaining T-O power under hot/high conditions without APR; increased maximum payload; other improvements as detailed under Design Features below. Spanish type certificate 30 March 1998. Available in configurations described below.

400 Airliner: Standard seating for 26 passengers, or 24 if lavatory included.

Detailed description applies to 400 Airliner except where indicated.



CASA C-212 Series 400 (Dennis Punnett)

1158767

400 Utility: Standard seating for 23 passengers, or 21 if lavatory included, with maximum capacity for 26.

400M: Military troop/cargo/general purpose transport.

Patrullero: Special missions (anti-submarine and maritime patrol) versions; described separately.

CASA C-212-400 PRODUCTION AND ORDERS (at August 2006)

Country	Customer	Total
Australia	Skytraders	2 ⁶
Brazil	Air Force	TBD ⁹
Dominican Republic	Air Force	3 ⁴
Ecuador	Army	2 ⁸
Lesotho	Defence Force	1 ⁵
Paraguay	Air Force	1 ⁷
Spain	Min of Agriculture, Fisheries and Food	3 ³
Suriname	Air Force	2 ²
USA	EADS CASA (demonstrator)	2
	Phillips Alaska/BP	1
Venezuela	Navy	3 ¹
Total		20+

¹ Delivered May 1998

² Includes one Patrullero; first delivered December 1998, second (Patrullero) in May 1999

³ Patrullero. First delivered December 1998; second in March 2001; third in May 2003

⁴ Third aircraft delivered 12 December 2000

⁵ Delivered 18 September 2001

⁶ Deliveries began April 2004; Antarctic operation

⁷ Delivered 21 February 2004; ambulance conversion kit

⁸ Deliveries began March 2005

⁹ Selected August 2006: 'up to 50' requirement; contract expected by year-end

CUSTOMERS: See table. Total 475 of all versions sold by August 2006; total includes Series 200s still to be completed by Dirgantara of Indonesia. C-212s of all Series have been purchased or leased by over 40 military and 50 civil operators in 38 countries and had accumulated over 2.5 million hours by 1999.

Selected August 2006 by Brazilian Air Force (FAB) as C-95 Bandeirante replacement. Up to 50 required, with first eight to be completed from CKD kits at FAB maintenance centre, Campo de Marte, progressing to 40 per cent local manufacture by final 10 aircraft. Possible further 30 to be acquired in 2010-11 period.

DESIGN FEATURES: Typical high-wing, rear-loading military transport.

Wing section NACA 65₁-218; no dihedral; incidence 2° 30'; swept winglets canted upwards at 45°; meets FAR Pt 26 noise limits.

Series 400 features engine change (see Power Plant); avionics upgrade; underfloor avionics boxes relocated to former nose baggage compartment, facilitating ventral installation of a 360° scan radar and eliminating need for special-shape 'platypus' nose of earlier Patrullero versions, which allowed only 270° scan; relocated pressure refuelling point; main cabin refurbished; cargo winch option.

FLYING CONTROLS: Conventional and manual. Trim tab in port aileron; trim and geared tabs in rudder and each elevator; double-slotted flaps.

STRUCTURE: All-metal light alloy fail-safe structure; unpressurised; two-spar tailplane and fin.

Wing centre-section, forward and rear passenger doors and dorsal fin manufactured by AISA.

LANDING GEAR: Non-retractable tricycle type, with single mainwheels and single steerable nosewheel. CASA oleo-pneumatic shock-absorbers. Goodyear wheels and tyres, main 11.00-12 (10 ply), nose 24x7.7 (8 ply). Tyre pressure 3.86 bar (56 lb/sq in) on main units, 4.14 bar (60 lb/sq in) on nose unit. Goodyear hydraulic disc brakes on mainwheels. No brake cooling. Anti-skid system optional. Skytraders' two C-212-400s were equipped in 2004 with Kehler snow skis - the first C-212s to be fitted with this type of gear.

POWER PLANT: Two 690 kW (925 shp) Honeywell TPE331-12JR-701C engines. Dowty Aerospace R-334/4-82-F/13 four-blade, constant-speed, fully feathering, reversible-pitch propellers.

Fuel in four integral wing tanks, with total capacity of 2,040 litres (539 US gallons; 449 Imp gallons), of which 2,000 litres (528 US gallons; 440 Imp gallons) usable. Gravity refuelling point above each tank. Single pressure refuelling point in starboard mainwheel fairing. Additional fuel can be carried in one 1,000 litre or two 750 litre (264 or 198 US gallon; 220 or 165 Imp gallon) optional ferry tanks inside cabin, and/or two 500 litre (132 US gallon; 110 Imp gallon) auxiliary underwing tanks. Oil capacity 4.5 litres (1.2 US gallons; 1.0 Imp gallon) per engine.

ACCOMMODATION: Crew of two on flight deck; cabin attendant in civil version. Ergonomically redesigned flight deck; improved cabin soundproofing, sidewall design, lighting and toilet; 400M, foldaway seats along each side of cabin.

For troop transport role, main cabin can be fitted with 25 inward-facing seats along cabin walls, to accommodate 24 paratroops with instructor/jumpmaster; or 25 fully equipped troops. As ambulance, cabin is normally equipped to carry 12 stretcher patients and four medical attendants. As freighter, up to 2,950 kg (6,504 lb) of cargo can be carried in main cabin, including two LD1, LD727/DC-8 or three LD3 containers, or light vehicles. Cargo system, certificated to FAR Pt 25, includes roller loading/unloading system and 9 g barrier net. Photographic version equipped with two RC-20/30 vertical cameras and darkroom. Navigation training version has individual desks/consoles for instructor and five pupils, in two rows, with appropriate instrument installations.

Civil passenger transport version has standard seating for up to 26 in mainly three-abreast layout at 72 cm (28.5 in) pitch, with provision for quick change to all-cargo or mixed passenger/cargo interior. Lavatory, galley and 400 kg (882 lb) capacity baggage compartment standard, plus additional 150 kg (330 lb) in nose bay. VIP transport version can be furnished to customer's requirements.

Forward/outward-opening door on port side immediately aft of flight deck; forward/outward-opening passenger door on port side aft of wing; inward-opening emergency exit opposite each door on starboard side. Additional emergency exit in roof of forward main cabin. Two-section underfuselage loading ramp/door aft of main cabin can be opened in flight for discharge of paratroops or cargo, and can be fitted with optional external wheels for door protection during ground manoeuvring. Interior of rear-loading door can be used for additional baggage stowage in civil version. Entire accommodation heated and ventilated; air conditioning optional.

SYSTEMS: Freon cycle or (on special mission versions) engine bleed air air conditioning system optional. Hydraulic system, operating at service pressure of 138 bar (2,000 lb/sq in), provides power via electric pump to actuate mainwheel brakes, flaps, nosewheel steering and rear cargo ramp/door. Hand pump for standby hydraulic power in case of electrical failure or other emergency. Electrical system supplied by two 9 kW starter/generators, three



Ski-equipped CASA 212 Series 400 operated in Polar regions by Skytraders on behalf of Australian government's Antarctic Division (AAD) (Paul Jackson) 1158858

batteries and three static converters, Pneumatic boot and engine bleed air de-icing of wing and tail unit leading-edges; electric de-icing of propellers and windscreens, Oxygen system for crew (including cabin attendant); two portable oxygen cylinders for passenger supply. Engine and cabin fire protection systems.

AVIONICS: *Comms:* Rockwell Collins VHF, ATC transponder, intercom and PA system standard; ELT: Rockwell Collins HF, UHF and second transponder, and Fairchild CVR, optional.

Radar: Honeywell weather radar standard, RDR-1500B search radar in ventral radome on Patrullero versions.

Flight: Rockwell Collins VOR/ILS, ADF, DME and radio altimeter, and Honeywell AFCS and directional gyro, standard; second Rockwell Collins ADF, Global Omega nav, Dorne & Margolin marker beacon receiver and Fairchild flight data recorder optional, Flight management system (FMS) incorporates VOR, ADF, DME and GPS nav receiver.

Instrumentation: EFIS with four CRTs; IEDS (integrated engine data system) with two colour LCDs, Blind-flying instrumentation standard.

EQUIPMENT: 1,000 kg (2,205 lb) capacity cargo winch optional.

ARMAMENT (military versions, optional): Two machine gun pods or two rocket launchers, or one launcher and one gun pod, on hardpoints on fuselage sides (capacity 250 kg; 551 lb each).

DIMENSIONS, EXTERNAL:

Wing span	20.27 m (66 ft 6 in)
Wing chord: at root	2.50 m (8 ft 2½ in)
at tip	1.25 m (4 ft 1¼ in)
Wing aspect ratio	10.0
Length overall	16.15 m (52 ft 11¾ in)
Fuselage max width	2.30 m (7 ft 6½ in)
Height overall	6.60 m (21 ft 7¾ in)
Tailplane span	8.40 m (27 ft 6¾ in)
Wheel track	3.10 m (10 ft 2 in)
Wheelbase	5.46 m (17 ft 11 in)
Propeller diameter	2.79 m (9 ft 2 in)
Propeller ground clearance (min)	1.44 m (4 ft 8¾ in)
Distance between propeller centres	5.27 m (17 ft 3¼ in)
Passenger door (port, rear): Height	1.58 m (5 ft 2¼ in)
Width	0.70 m (2 ft 3½ in)
Crew and servicing door (port, fwd):	
Max height	1.10 m (3 ft 7¼ in)
Width	0.58 m (1 ft 10¾ in)
Rear-loading door: Max length	3.66 m (12 ft 0 in)
Max width	1.68 m (5 ft 6¼ in)
Max height	1.80 m (5 ft 10¾ in)
Emergency exit (stbd, fwd): Height	1.10 m (3 ft 7¼ in)
Width	0.58 m (1 ft 10¾ in)
Emergency exit (stbd, rear): Height	0.95 m (3 ft 1½ in)
Width	0.56 m (1 ft 10 in)

DIMENSIONS, INTERNAL:

Cabin (excl flight deck and rear-loading door):	
Length: passenger	7.27 m (23 ft 10¼ in)
cargo/military	6.55 m (21 ft 5¼ in)
Max width	2.10 m (6 ft 10¾ in)
Max height	1.80 m (5 ft 10¾ in)
Floor area: passenger	13.5 m² (145 sq ft)
cargo/military	12.2 m² (131 sq ft)
Volume: passenger	23.8 m³ (840 cu ft)
cargo/military	22.0 m³ (777 cu ft)
Cabin: volume incl flight deck and rear-loading door	30.4 m³ (1,074 cu ft)
Baggage compartment volume	3.6 m³ (127 cu ft)

AREAS:

Wings, gross	41.00 m² (441.3 sq ft)
Ailerons (total, incl tab)	1.875 m² (20.18 sq ft)
Trailing-edge flaps (total)	2.14 m² (23.03 sq ft)
Fin, incl dorsal fin	6.58 m² (70.83 sq ft)
Rudder, incl tab	2.16 m² (23.25 sq ft)
Tailplane	12.57 m² (135.30 sq ft)
Elevators (total, incl tabs)	1.78 m² (19.16 sq ft)

WEIGHTS AND LOADINGS:

Manufacturer's weight empty	3,780 kg (8,333 lb)
Weight empty, equipped (cargo)	4,550 kg (10,031 lb)
Max cargo payload	2,950 kg (6,504 lb)

Max fuel: standard	1,600 kg (3,527 lb)
with underwing auxiliary tanks	2,400 kg (5,291 lb)
Max T-O and landing weight	8,100 kg (17,857 lb)
Max ramp weight	8,150 kg (17,967 lb)
Max zero-fuel weight	7,500 kg (16,535 lb)
Max cabin floor loading	732 kg/m² (150 lb/sq ft)
Max wing loading	197.6 kg/m² (40.46 lb/sq ft)
Max power loading	6.04 kg/kW (9.92 lb/shp)

PERFORMANCE (Series 400M):

Max cruising speed at FL100	195 kt (361 km/h; 224 mph)
Econ cruising speed at FL100	163 kt (302 km/h; 188 mph)
Time to FL100	8 min
Service ceiling	7,925 m (26,000 ft)
Service ceiling, OEI	3,275 m (10,740 ft)
T-O to 15 m (50 ft)	587 m (1,925 ft)
Landing from 15 m (50 ft)	527 m (1,730 ft)
Required runway length for STOL operation	402 m (1,320 ft)

Range:

with max payload	233 n miles (431 km; 268 miles)
with max standard fuel and 2,000 kg (4,409 lb) payload	800 n miles (1,481 km; 920 miles)
with max standard and auxiliary fuel and reduced payload	1,375 n miles (2,546 km; 1,582 miles)

CASA C-212 PATRULLERO

TYPE: Maritime surveillance twin-turboprop.

DESIGN FEATURES: Special missions versions of C-212 (various Series).

CURRENT VERSIONS: **MP:** Maritime patrol version; belly-mounted 360° search radar and FLIR/TV turret. Other features include operator's console, datalink via Inmarsat, external loudspeakers, searchlight, observation bubble windows, camera, and seating for 10 passengers. Initial C-212-400MP deliveries to Spanish Ministry of Agriculture, Fisheries and Food (one in December 1998 and a second on 29 March 2001) and Suriname Air Force (one in May 1999); third for Spanish MAFF delivered in May 2003.

Pollution control: Equipment as for MP, plus dedicated sensor for detection, measurement and control of harvest plagues, marine resources and pollution. This equipment has been fitted in Swedish Coast Guard and Portuguese Air Force C-212s.

CUSTOMERS: See table with main C-212-400 entry. More than 56 Patrulleros of all Series sold by mid-2005. 'Tentative contract' for one by South Korean coast guard reported in February 2006, but not confirmed by December that year.

POWER PLANT: As relevant C-212 Series. Two 500 litre (132 US gallon; 110 Imp gallon) underwing auxiliary fuel tanks.

ACCOMMODATION: Flight crew of two; mission sensor operator and observer in MP. Two observer stations at bubble windows in rear of cabin. Operator console with search radar, FLIR/TV, moving map and communications control. Radar repeater display and searchlight control added to flight deck. Galley, lavatory and rest area equipped with commuter seats or stretchers.

AVIONICS (MP): *Comms:* Single VHF, UHF/VHF and HF radios; intercom; IFF.

Radar: 360° scan underfuselage radar.

Flight: Redundant flight management system with dual GPS nav.

Instrumentation: Four-screen EFIS; IEDS.

Mission: FLIR/TV turret, Inmarsat datalink, electronic cartography and camera in MP. Additional to, or independent of, this equipment, Pollution control version can be fitted with a SLAR, IR/U/V scanner or microwave radiometer.

EQUIPMENT: Survival kit and raft launcher in rear ramp; searchlight on fuselage hardpoint.

ARMAMENT: Hardpoint (capacity 500 kg; 1,102 lb) on each side of fuselage, on which can be carried machine gun pods or rocket launchers.

PERFORMANCE:

Endurance with underwing fuel tanks	8 h 30 min
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CASA C-295

Spanish Air Force designation: T.21

TYPE: Twin-turboprop transport.

PROGRAMME: Stretched derivative of Airtech CN-235M (which see). Initiated November 1996, after market survey, as unilateral development of CASA/IPTN CN-235. Announced at Paris Air Show, June 1997. Prototype (EC-295 Ciudad de Getafe), a converted CN-235, flew for first time 28 November 1997 and had accumulated 801 hours in 379 sorties and 555



First C-295M for Brazilian Air Force, delivered 23 October 2006

1158826

landings by 17 December 1999. First production C-295 (EC-296 Ciudad de Sevilla), designated S-1, made its maiden flight on 22 December 1998; had flown 516 hours in 232 sorties and 379 landings by 17 December 1999.

Certified by INTA (for military operations) on 30 November 1999; DGAC certification received 3 December 1999 and FAA (FAR Pt 25) certification on 17 December 1999; first customer aircraft (XT.21-02) demonstrated at Paris in June 2001.

CURRENT VERSIONS: **C-295M:** Military version; as described. Ordered by air forces of Algeria, Brazil, Jordan, Poland and Spain.

C-295MSA/MPA Persuader: Maritime patrol and anti-submarine version; equipped with CASA Fully Integrated Tactical System (FITS) mission suite. Ordered by air forces of Algeria and UAE (four each). Portuguese Persuaders described as VIMAR version.

CUSTOMERS: Total 54 ordered; see table. Spanish Air Force (launch customer) contract signed January 2000; deliveries began with handover of first (second production) aircraft, T.21-02 '35-40', to No. 35 Wing at Getafe; six delivered by October 2002 and completed by 2004. Polish Air Force ordered eight to replace An-26s of 13th Transport Squadron; delivery completed 28 July 2005; further four on option. Under a USD10.2 million amendment to the original contract, four of first eight Polish aircraft are fitted with titanium cockpit armour kits. EADS Defence Electronics AAR-60 missile launch detection systems and Indra ALR-300(V)2B radar warning receivers; the other four were wired to receive these systems later. All eight have Raytheon APX-100 IFF transponders. Brazilian 12 are to replace obsolete C-115 Buffalos. Three of Portugal's Persuaders will be equipped with FITS.

Selected by Swiss Air Force in December 2000 (two C-295M: CHF109 million funding approved 27 May 2004 but cancelled by Swiss Parliament on 17 March 2005). Four FITS-equipped C-295MSA/MPA selected 22 March 2001 by UAE (Abu Dhabi) to meet its Shaheen 1 requirement, but not yet under contract (December 2006). Venezuelan Air Force ordered 10 on 30 March 2005, but sale vetoed by US government in early 2006 on technology transfer grounds and abandoned by CASA October 2006.

C-295 ORDERS AND DELIVERIES
(at October 2006)

Customer	Qty	Version	Announced	First Delivery
Algeria	3	M ¹	03	Nov 05
	4	Persuader	03	?
Brazil	12	M	29 Apr 05	23 Oct 06
Finland	2 ²	M	15 May 06	?
Jordan	2	M	12 Feb 03	Sep 03
Portugal	7	M	17 Feb 06	Aug 07
	5	Persuader	17 Feb 06	?
Poland	10	M	28 Aug 01	15 Aug 03
Spain	9	M	30 Apr 99	15 Nov 01

Notes

¹ Includes two VIP

² Order for five more

COSTS: Eight for Poland cost USD212 million (2001); two for Jordan USD45 million (2003).

DESIGN FEATURES: Typical rear-loading, high-wing military transport. Conforms to FAR Pt 25 and MIL-STD-7700C. Compared with CN-235, has fuselage lengthened by six frames (three forward and three aft of wing); wing reinforced for higher operating weights and to support up to six optional underwing stores stations; additional 1,450 litres (383 US gallons; 319 Imp gallons) of fuel in wings; reinforced landing gear with twin nosewheels to facilitate operation from unprepared airstrips; modernised avionics identical to those of CN-235 Srs 300.

STRUCTURE: Provision for three hardpoints under each wing, capacities 800 kg (1,764 lb) inboard, 500 kg (1,102 lb) centre and 300 kg (661 lb) outboard.

LANDING GEAR: Main gear as CN-235 but reinforced for higher operating weights; twin nosewheels. Designed for sink rate of 3.05 m (10 ft)/s at normal MTOW and 2.74 m (9 ft)/s at overload MTOW; and operation from semi-prepared runways down to CBR-2 category.

POWER PLANT: Two Pratt & Whitney Canada PW127G turboprops, each with T-O rating of 1,972 kW (2,645 shp) normal, 2,177 kW (2,920 shp) with APR. Hamilton Sundstrand HS-568F-5 six-blade composites propellers with autofeathering and synchrophasing. Fuel capacity 7,650 litres (2,021 US gallons; 1,683 Imp gallons). Optional in-flight refuelling probe on starboard side of flight deck.

ACCOMMODATION: Crew of two; dual controls standard. Two or three longitudinal rows of foldaway seats in main cabin of C-295M for 71 troops; 48 paratroops (each 130 kg; 287 lb with full equipment); as a 12-stretcher intensive care unit or, in medevac configuration, 27 stretchers and four medical personnel. Lavatory, at front on port side, standard. In cargo role, can accommodate up to five 2.24 x 2.74 m (88 x 108 in) pallets, including one on rear ramp/door; or one 88 x 108 in and three 2.24 x 3.18 m (88 x 125 in) pallets; or three Land Rover-type light vehicles. Paratroop door each side at rear of cabin. Crew door aft of flight deck on starboard side, with emergency exit opposite on port side.

Persuader version accommodates, in addition to flight deck crew, two (MPA) or four (ASW) mission sensor operators, at identical, universal and configurable consoles; two

observers at bubble windows in rear of cabin; radar repeater added to flight deck; galley, lavatory, and rest area equipped with commuter seats.

SYSTEMS: Pressure differential 0.38 bar (5.58 lb/sq in), giving cabin atmosphere equivalent to 2,354 m (7,723 ft) at altitude of 7,620 m (25,000 ft).

AVIONICS: All-digital, and compatible with NVGs. Thales (Sextant) Topdeck displays standard. Thales is overall systems integrator.

Comms: Two Thales (Sextant) U/VHF-AM/FM and one HF radio; Honeywell IFF transponder and solid-state FDR; ELT; air data system. Honeywell solid-state CVR. Alternative com/nav/ident functions optional.

Radar: Honeywell RDR-1400C colour weather radar with search and beacon modes and ground mapping vertical navigation capability.

Flight: Four-dimensional FMS; dual ADU 3008 air data units; dual AHRS; dual multimode receivers; dual GPS receivers; dual multifunction control and display units; Honeywell enhanced GPWS. Two central data processor/interface units and standard digital busses (ARINC 429 and MIL-STD-1553B). Options include Thales (Sextant) Totem 3000 laser gyro navigation system, enhanced TCAS. Cat. II ILS, MLS and satcom.

Instrumentation: Four 152 x 203 mm (6 x 8 in) Thales (Sextant) LCDs; one integrated electronic standby instrument; two IFC cabinets with autopilot module; radar altimeter. Video images from E-O sensors such as FLIR or cameras can be displayed on the four LCDs. Full NVG compatibility. Provision for two Thales (Sextant) HUDs.

Mission: CASA FITS suite for Persuader versions includes a central (and optionally redundant) real-time tactical processor; four identical multifunctional consoles, interconnected via a local area network, each with its own RISC processor identical to the tactical processor; a 51 cm (20 in) high-resolution LCD; two touchscreens; and a keyboard and trackball; plus such peripherals as a pilot's presentation screen, recording and data loading units, and an armament and sonobuoy management panel.

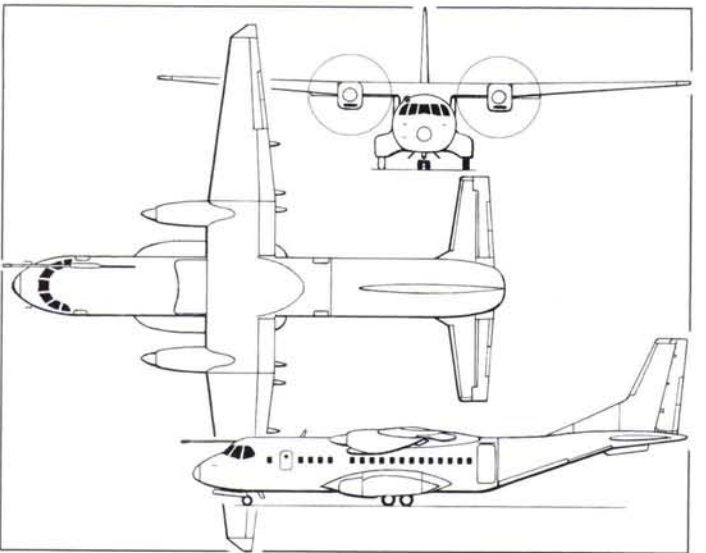
Self-defence: Self-protection suite (chaff/flare dispensers, missile approach and/or laser warning system) optional for Persuader.

EQUIPMENT (Persuader): Sonobuoy or flare and marker launcher, MAD, survival kit and raft launcher in rear ramp; externally mounted searchlight.

ARMAMENT (Persuader): Three hardpoints under each wing (capacities 800, 500 and 300 kg; 1,764, 1,102 and 661 lb) for torpedoes, ASMs or depth charges.

DIMENSIONS, EXTERNAL:

Wing span	25.81 m (84 ft 8¼ in)
Length overall	24.45 m (80 ft 2½ in)
Height overall	8.66 m (28 ft 5 in)
Tailplane span	10.60 m (34 ft 9¼ in)
Wheel track	3.98 m (13 ft 0¾ in)
Wheelbase	8.435 m (27 ft 8 in)
Propeller diameter	3.94 m (12 ft 11 in)
Distance between propeller centres	7.00 m (22 ft 11½ in)



C-295M derivative of the CN-235 (James Goulding)

1158768

Paratroop doors (two, each):	
Height	1.75 m (5 ft 9 in)
Width	0.90 m (2 ft 11½ in)
Crew door (fwd, stbd): Height	1.27 m (4 ft 2 in)
Width	0.73 m (2 ft 4¾ in)
Emergency exit (fwd, port): Height	0.91 m (3 ft 0 in)
Width	0.50 m (1 ft 7¾ in)
DIMENSIONS, INTERNAL:	
Cabin, excl flight deck:	
Length: excl ramp/door	12.69 m (41 ft 7½ in)
incl ramp/door	15.73 m (51 ft 7¼ in)
Max width	2.70 m (8 ft 10¼ in)
Width at floor	2.36 m (7 ft 9 in)
Max height	1.90 m (6 ft 2¾ in)
Volume available for cargo	56.86 m³ (2,008 cu ft)
WEIGHTS AND LOADINGS (A: normal; B: overload):	
Max payload: A	7,050 kg (15,543 lb)
B	9,250 kg (20,393 lb)
Max T-O weight: A	21,000 kg (46,297 lb)
B	23,200 kg (51,147 lb)
Max landing weight: A	20,700 kg (45,635 lb)
B	23,200 kg (51,147 lb)
Max zero-fuel weight: A	18,500 kg (40,784 lb)
B	20,700 kg (45,634 lb)

ELA

ELA AVIACIÓN S L

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DIRECTOR: Emilio Lopez, Sr

ELA has been designing and manufacturing autogyros since early 1990s. Current ELA-07 is also the basis of the Autogyro Europe MT-03, produced in Germany.

ELA-07

French marketing name: Raid'Air Adventure

TYPE: Two-seat autogyro ultralight.

CUSTOMERS: Total of some 90 built by early 2006.

COSTS: EUR43,000 (2005).

DESIGN FEATURES: Open, tandem-seat, pod-and-boom configuration with sweptback central fin, plus stabilising fins at tailplane ends; ELA-07S version has rear cockpit faired in and provided with additional windscreen. Large rudder on central fin only. Rotor pre-rotation to 300 rpm by metal tube drive with universal joints. In-flight trim system comprises two-way hydraulic piston at rotor head controlled electrically by switch adjacent to throttle; system doubles as rotor brake.

STRUCTURE: Welded, rectangular, stainless steel tube keel; carbon fibre pod and empennage. Extruded aluminium rotor.

LANDING GEAR: Tricycle type; fixed. Cantilever composites spring mainwheel legs with optional speed fairings and hydraulic disc brakes.

POWER PLANT: Rotax flat-four air-cooled piston engine; option of 73.5 kW (98.6 hp) 912 ULS and 84.5 kW (113.3 hp) turbocharged 914. Fuel capacity 85 litres (22.5 US gallons; 18.7 Imp gallons) in composites (welded aluminium until 2006) tank under rear seat.

Max power loading: A	5.32 kg/kW (8.75 lb/shp)
B	5.89 kg/kW (9.67 lb/shp)
PERFORMANCE (C-295M at normal MTOW except where indicated):	
Max cruising speed at optimum altitude	260 kt (482 km/h; 299 mph)
Time to optimum cruising altitude	12 min
Absolute ceiling	9,145 m (30,000 ft)
Service ceiling, OEI	4,125 m (13,540 ft)
T-O run at S/L: A, ISA	844 m (2,770 ft)
A, ISA + 20°C	934 m (3,065 ft)
T-O to 15 m (50 ft) at S/L:	
A, ISA	1,025 m (3,365 ft)
A, ISA + 20°C	1,103 m (3,620 ft)
Landing from 15 m (50 ft)	729 m (2,390 ft)
Landing run	420 m (1,380 ft)
Range, ISA, reserves for 45 min hold at 460 m (1,500 ft):	
with max payload:	
A	840 n miles (1,555 km; 966 miles)
B	690 n miles (1,277 km; 794 miles)
with max fuel:	
A with 2,940 kg (6,482 lb) payload	2,477 n miles (4,587 km; 2,850 miles)
B with 8,000 kg (17,637 lb) payload	1,160 n miles (2,148 km; 1,334 miles)
Ferry range	2,700 n miles (5,000 km; 3,107 miles)
g limits: A	2.53
B	2.25



ELA-07S tandem-seat autogyro

1158664

EQUIPMENT: Optional GRS ballistic recovery parachute.

WEIGHTS AND LOADINGS (Rotax 914 engine):

Weight empty	244 kg (538 lb)
Max T-O weight: Europe	450 kg (992 lb)
US	500 kg (1,102 lb)

PERFORMANCE (Rotax 914 engine):

Cruising speed at 65% power	78 kt (145 km/h; 90 mph)
Econ cruising speed	62 kt (115 km/h; 71 mph)
Max rate of climb at S/L	480 m (1,575 ft)/min
T-O run	50 m (165 ft)
Range at 65% power	351 n miles (650 km; 403 miles)

VOL MEDITERRANI

VOL MEDITERRANI SL

Promotion of the Esqual two-seat ultralight is now handled by Esqual.com of Belgium.

Sweden

SAAB

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SENIOR VICE-PRESIDENT, COMMUNICATIONS: Jan Nygren

PRESS DIRECTOR: Anders Stålhammar

Svenska Aeroplan AB founded at Trollhättan 1937 to make military aircraft; amalgamated 1939 with Aircraft Division of Svenska Järnvägsverkstäderna rolling stock factory at Linköping; renamed Saab Aktiebolag May 1965; merged with Scania-Vabis 1968 to combine automotive interests; Malmö Flygindustri acquired 1968. Bid for Celsius AB 16 November 1999 and acquisition completed 8 March 2000; enlarged company reorganised in 2000 into six main business areas and several independent operations:

Saab Aerospace: Combining military aircraft, future aerospace systems and commercial programmes. Described in further detail.

Saab Aviation Services: Commercial aircraft maintenance and engine and component maintenance. Comprises Celsius Aviation Services, Saab Aircraft and Saab Aircraft Leasing; holds type certificates for Saab 340 and Saab 2000 regional turboprop airliners, production of which ended in 1999.

Saab Systems and Electronics: Electronic warfare, simulation and training and radar control, including Combitech Systems and Ericsson Saab Avionics.

Saab Bofors Dynamics: Missiles, anti-armour and underwater systems.

Saab Technical Support and Services: Including aircraft maintenance.

Saab Ericsson Space: Digital, microwave and mechanical products.

It was announced on 30 April 1998 that Saab's owner, Investor AB, had approved the sale to British Aerospace plc (now BAE Systems) of a 35 per cent voting shareholding. Investor remained Saab's leading owner, with 36 per cent of the votes and 20 per cent of the capital. Purchase rights to the remaining 29 per cent of votes and 45 per cent of capital continued to be offered to Investor shareholders. Announced 7 December 2004 that from 1 January 2005, BAE share in Saab AB reduced to minimum of 20 per cent; at same time, Saab took lead in export marketing through previously equally shared Gripen International company.

More than 4,000 military and commercial aircraft delivered since 1940; has held dealership for MD Helicopters (formerly Schweizer/Hughes, McDonnell Douglas and Boeing) products in Scandinavia and Finland since 1962. In September 2000, Saab announced entry into design of UAVs, in conjunction with Swedish Defence Materiel Administration and other local industries.

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MANAGING DIRECTOR: Johan Lehander

DEPUTY MANAGING DIRECTOR: Kjell Möller

MARKETING DIRECTOR: Bob Kemp

COMMUNICATIONS DIRECTOR: Owe Wagermark

On 14 July 2003, Saab's Aerospace division was restructured into two business units and a support organisation:

Saab Aerosystems: Operating areas include defence market, including Gripen, advanced air combat systems such as UAVs, and subsystems for other aircraft.

Saab Aerostructures: Responsible for fuselage and structural components manufacture for Gripen, Airbus, Boeing, helicopters and other aircraft.

Saab Support: Group services for business units at Linköping, co-ordinated with other sites.

Aerostructures work includes floor assemblies, pylons and landing gear doors for the Airbus A340-500/600 series and components for A320. Saab also partner in A380 and A400M programmes, having signed contract for A400M crew door development and production in November 2004. Builds A380 wing panels (first mid- and outer leading-edge delivered 24 April 2003); crew doors and wingtip panels for Boeing 737; and wing components for Boeing 777. In 2005, secured Boeing 787 Dreamliner contracts for passenger and cargo door design and manufacturing; and development, production and support of control system for slats and flaps. Developing new tactical system for NH90 helicopter under contract placed in early 2002. Saab group sales include 40 per cent exports and are 70 per cent defence-related.

Main activity of Aerosystems is development and production of Gripen multirole fighter.

Original Industrigruppen JAS AB (JAS Industry Group) formed 1981 to represent (then) Saab-Scania (65 per cent share), Ericsson (16 per cent), Volvo Flygmotor (15 per cent) and FFV Aerotech (4 per cent) in JAS 39 Gripen programme; continues to act as contractor for Försvarets Materielverk (Defence Materiel Administration, FMV) and co-ordinated JAS 39 Gripen programme within Sweden. Volvo Flygmotor became Volvo Aero in 1994 and FFV Aerotech share passed to Celsius in 1990 through merger with Bofors. International marketing of JAS 39 Gripen is now responsibility of Saab and BAE Systems, acting jointly since November 1995; current members of JAS Industry Group are subcontractors.

Workshare on export orders would be Saab 55 per cent/BAE 45 per cent under agreement signed 12 June 1995. BAE involvement also includes manufacture of main landing gear, the first of which was delivered from the Brough factory in April 1996 and incorporated in 49th production Gripen. From May 1999, BAE also responsible for assembly of wing attachment unit and associated component join-up for two-seat aircraft (single-seaters to follow).

UK and Swedish export guarantee departments signed an agreement in August 1996 to finance any third-party sales. A contract of 16 November 1995 provides for Danubian Aircraft Company of Hungary to manufacture Gripen components at Tököl as part of a wider Swedish-Hungarian defence information exchange agreement signed 18 December 1995. First Hungarian parts (tailcone fittings) delivered April 1996. Further Swedish-Hungarian agreement of 22 January 1997 provided for comprehensive industrial offsets in the event of a Gripen purchase. First South African parts — Denel-built assembly set for stores pylon — handed over April 2000. Contract awarded to Denel in March 2001 for manufacture of section of centre fuselage for 40 Lot 3 Gripens, plus 28 for SAAF aircraft. Polish part manufacture (metal subassemblies) began July 2000 at PZL (Polish Aircraft Factory).

Gripen International formed 3 September 2001 to strengthen Saab-BAE Systems marketing ventures; is jointly owned and staffed, but registered in Sweden.

SAAB JAS 39 GRIPEN

English name: Griffin

TYPE: Multirole fighter.

PROGRAMME: Funded definition and development began June 1980; initial proposals submitted 3 June 1981; government approved programme 6 May 1982; initial FMV development contract 30 June 1982 for five prototypes and 30 production aircraft, with options for next 110; overall go-ahead confirmed second quarter 1983; first test runs of RM12 engine January 1985; Gripen HUD first flown in Viggen testbed February 1987; study for two-seat JAS 39B authorised July 1989.

First of five single-seat prototypes (39-1) rolled out 26 April 1987; made first flight 9 December 1988 but lost in landing accident after fly-by-wire problem 2 February 1989; only six sorties flown. Subsequent first flights 4 May 1990 (39-2), 20 December 1990 (39-4), 25 March 1991 (39-3) and 23 October 1991 (39-5); the 2,000th Gripen sortie was flown (by 39-4) on 22 December 1995; modified Viggen (37-51) retired at end of 1991 after assisting with avionics trials (nearly 250 flights); two single-seat fatigue test airframes



Czech Saab JAS 39C Gripen (Jan Cadil)

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Hungarian Saab JAS 39 EBS HU Gripen (Victor Veres)

1159328

(39-51 discarded 1993; 39-52 began 16,000 hour programme, August 1993 and achieved 8,000 hours in early 1996). Second production batch (Lot 2: 110 aircraft) approved 3 June 1992; first production Gripen (39101) made first flight 10 September 1992 and joined test programme in lieu of 39-1; flight test programme in 1995-96, included high-AoA (at least 28° achieved) and spin trials by 39-2 and trials of an APU (for Lot 2 production) by 39-4. All development work in the original (Lot 1) contract had been completed by late 1996; total programme was over 1,800 hours in 2,300 sorties by six aircraft. By 1996 had demonstrated M1.08 cruise without reheat. Follow-on trials with mockup aerial refuelling probe conducted by 39-4 on eight sorties between 2 and 17 November 1998 from RAF VC10 K. Mk 4. First flight of JAS 39C with refuelling probe extended June 2004. Captive flight of two KEPD 150 Taurus SOMs on inner wing pylons of 39145 of F7 conducted on 27 August 1998. Live Raytheon AIM-120 AMRAAM firings by 39-5 in April 1998.

Initial production aircraft for Swedish Air Force (39102) made first flight 4 March 1993 and was handed over to FMV 8 June 1993; flight control software modified following loss of 39102 in crash on 8 August 1993 and installed from December 1994; further software upgrade to new-generation P11 standard (introducing 11 filters to prevent pilot-induced oscillations) first flown 22 March 1995 in trials aircraft and installed in test Gripens from late 1995; in production aircraft (known then as R11) built after early 1996 (and retrofitted from 1997 as R11-9); modified control stick introduced with production aircraft 39108 (first flight 11 April 1995). R12:3 flight control software under trial by late 1999, bringing Gripen up to original design goals; installed during following year as R12:4. Next stage is R14, increasing MTOW by some 1,000 kg (2,205 lb).

PP12 display processor for Lot 2 colour displays first flown August 1995. Thrust-vectoring under consideration for Gripen; first stage is proposed participation in further trials programme of Rockwell/DASA X-31. JAS 39B prototype rolled out 29 September 1995; first flight 29 April 1996.

Initial 30 production JAS 39As delivered 1993-96 (five in 1994; six in 1995, comprising 39108 to 112 and 120; and last of balance—39129—on 13 December 1996); by 2002, these all upgraded to Lot 2 standard; deliveries of second lot of 110 began 19 December 1996, and completed in 2003; Swedish Parliament authorised third batch of 64 on 13 December 1996; contract formally placed on 26 June 1997; deliveries between 2003 and 2007. Saab contracted on 24 November 1999 to supply new EWS 39 defensive aids suite, designed by Ericsson Saab Avionics and with substantial CelsiusTech content. In same month, Gripen made first flight with FADEC, as destined for Lot 3 aircraft.

First unit was F7 Wing at Sätenäs; maintenance training begun May 1994 at Linköping; conversion scheduled to begin 1 October 1995 but postponed to 1996, with pilot training centre at Sätenäs officially opened 9 June 1996; Gripen IOC achieved September 1997, following three-week field exercise by 2/F7 Squadron. Last of F7's previous Viggens withdrawn in October 1998. By mid-2002 SwAF Gripens had flown 34,000 sorties and 25,000 hours. SwAF received 100th Gripen on 12 March 2001 and 113 by 31 December that year. Final JAS 39A (and first JAS 39C) delivered 6 September 2002.

Gripen being promoted in several fighter competitions, as described in Customers section. On 18 November 1998, it was announced that the aircraft had been selected for purchase by the South African Air Force and this was confirmed by contract signature on 3 December 1999. In connection with SAAF requirement, Gripen completed initial series of trials with helmet-mounted display (Thales Optronics Guardian) in February 2001. Further testing of Cobra helmet by South African pilot aboard Gripen began December 2005. Trials of refuelling probe with South African Boeing 707 during March and April 2005 in some 400 connections; with Swedish C-130 Hercules tanker in November 2005.

CURRENT VERSIONS: **JAS 39A:** Standard single-seater. Final aircraft delivered 6 September 2002.

Description applies to JAS 39A except where indicated.

JAS 39B: Two-seater with 0.655 m (2 ft 1 3/4 in) fuselage plug and lengthened cockpit canopy. Primary roles conversion and tactical training, but also combat-capable. Not used for instruction until January 2002, when first students from pilot training began conversion. Avionics essentially as for JAS 39A and both cockpits identical, except no HUD in rear;



Swedish Saab JAS 39C Gripen armed with GBU-16 and GBU-10 bombs, laser designation pod and wingtip Rb 74 Sidewinders (Per Kustrvik)

1159326



First Saab JAS 39D Gripen for South Africa (Frans Dely)

1159325

instead, HUD image from front seat can be presented on flight data display in rear cockpit. Boosted environmental control system (ventral air intake replaces twin scoops on fuselage sides); inflatable airbag protects rear occupant during pre-ejection canopy fracturing. Reduced internal fuel; no internal gun.

Prototype entered final assembly 1 September 1994; first flight (39800) 29 April 1996; first production two-seater (39801) completed final assembly on 29 February 1996 and flew on 22 November; production deliveries began with 39802 on 19 May 1998.

Fatigue test specimen (39-71) also built; began a simulated 16,000 hour programme in February 1996.

JAS 39C and D: New features warrant revised designations for JAS 39A and B; improvements include full-colour displays, FADEC, helmet-mounted sight, new (Modular Airborne Computer System) processor for PS-05/A radar, Saab Dynamics IR-OTIS IR search and tracking system, in-flight refuelling probe and enhanced EW systems. IR-OTIS tested on Saab Viggen in 1997.

Originally planned for introduction at start of Lot 3, but final 19 Lot 2 aircraft (plus one testbed, 39207/39-6, first flown 29 April 2002) completed to interim standards with refuelling probes and upgraded computers and designated JAS 39C. First production aircraft (JAS 39C 39208) flown 14 August 2002 and to FMV for service trials 6 September 2002. Initial JAS 39D production aircraft (39815) flew 2 June 2004.

An electronically scanned radar antenna is under development for a potential Gripen MLU in 2010. By 2000, plans in hand to deliver all 14 Lot 3 two-seat Gripens in **JAS 39D C²** configuration with entirely redesigned rear cockpit for command and control duties.

JAS 39 EBS HU: Export basic standard, Hungary. Ordered February 2003 in form of remanufactured JAS 39A/BS.

Enhanced Gripen: First details mid-2001; service entry then envisaged in 2010; options under investigation included improved EW systems with laser warning, missile approach warning linked to towed decoys and EW function incorporated in electronically scanned radar. Range enhanced by standardisation on two-seat airframe, with fuel in place of rear cockpit, and/or conformal tanks; new engine, possibly EJ200, M88 or F414. Navalised Gripen reportedly under consideration by India in 2002.

In 2006, **Gripen DK** and **Gripen N** disclosed as being in concept stage for Denmark and Norway, respectively, following requests for information (RFI) as alternative to replacement of local F-16 Fighting Falcons by Lockheed Martin F-35 Lightning II (JSF), beginning 2013. Features include increased range; increased payload; and enhanced electronic warfare suite. Conformal tanks rejected for additional fuel, space having been identified within existing airframe, augmented by standard external tanks, to increase range by some 40 per cent. Electronically scanned version of PS-05 radar expected; GE F414 engine possible.

CUSTOMERS: Swedish Air Force requirement was originally 280, to equip 16 squadrons, second eight replacing JA and JAS Viggens; this reduced when third batch authorisation (December 1996) covered only four squadrons, thus amending requirement to 204 (including 28 JAS 39B two-seat versions); however, prototype JAS 39B added to first batch as conversion of aircraft under production, further amending contracts to 175 single-seat and 29 two-seat. By mid-2006, Swedish defence plans calling for total Gripen strength of some 100 JAS 39C/Ds, implying upgrade of some 31 earlier aircraft to C/D standard.

First 30 ordered with prototypes and full-scale development 30 June 1982; next 110 (of which first — 39131 — flew on 20 August 1996) include 14 JAS 39Bs and 20 JAS 39Cs; black radomes on 39109 to 39127; low-visibility markings from 39128, augmented by light grey (previously medium grey) radomes from 39131. Third lot of 64 (also including 14 two-seaters) for delivery between 2003 and 2007 are to JAS 39C/D standard.

Some Lot 3 improvements incorporated early in final 20 Lot 2 aircraft, (which redesignated JAS 39C), comprising refuelling probe and substantially improved computer (unofficially known as 'Mk 3') including D96 (MACS) processor to simplify possible later upgrade to colour displays.

First operational squadron was 2/F7, September 1997, followed by 1/F7 12 months later. F10 at Ängelholm followed in 1999–2000, conversion of pilots (by F7) having begun on 11 March 1999, followed by arrival of first two aircraft on 30 September 1999; first squadron (2/F10) operational September 2000, with second following in mid-2001, F10 disbanded by 31 December 2002 and transferred its equipment to F17 at Kallinge, latter being inaugurated as Gripen unit on 14 June 2002. F4 at Frosen-Ostersund began conversion of 1/F4 in September 2004, while F21 at Luleå received first two Gripens on 17 January 2002 (although its second squadron not operational until 2005). From 1 January 2004, 2/F17 ('172 Squadron') is Swedish Air Force Rapid Reaction Unit, for worldwide deployment at 30 days' notice, equipped with eight JAS 39As. Second squadron of F17 receiving JAS 39Cs, beginning 15 September 2004, these to SAFRRU role in 2006. However, F4 disbanded 17 June 2005 when only half-equipped. Current defence structure is six Gripen squadrons: 1/F17, 2/F17, 1/F21 and 2/F21 with JAS 39C/Ds, plus 1/F7 and 2/F7 as JAS 39A/B-equipped training unit.

Exports of some 250 anticipated over 20 years from 1996; by then, Saab and BAE engaged in 12 export campaigns; presentations made to Austria, Brazil, Czech Republic, Chile and Poland in 1996–97. Promotion in Philippines, Slovenia and South Africa, 1997. Details of competitions summarised below.

Australian Air 6000 requirement received Gripen response on 1 February 2002, but Lockheed Martin F-35 Lightning II selected June 2002.

Austrian RFP received October 2001 for up to 30 new fighters; Gripen proposal delivered 22 January 2002, based on either 24 single- and four two-seat aircraft for early delivery; or

12 leased aircraft as lead-in to later delivery of 24 plus six new-build Gripens. Revised proposals, delivered to Austria on 30 April 2002, envisaged accelerated delivery between mid-2005 and mid-2007, but Eurofighter Typhoon eventually selected by parliament on 2 July 2002, although almost immediately suspended, then reinstated.

Brazilian RFP received August 2001 for potential 24 aircraft. Revised proposals delivered to Brazil on 3 May 2002. Programme suspended 2003.

Czech Republic RFP issued 27 December 2000; invitation to tender for new fighter issued 9 January 2001; Saab response delivered 31 May 2001 for 24 or 36 aircraft with 150 per cent offsets. Plan officially confirmed on 10 December 2001 for 24 Gripens valued at Kcs50 billion, including spares and training; first squadron to be operational in 2005 and second and final in 2008. Formal approval given 22 April 2002, contract signing due before end of year, but programme was abandoned in November 2002 and replaced by quest for 12 to 14 aircraft, with Gripen still among contenders. Gripen lease recommendation made by evaluation committee on 17 December 2003, and on 14 June 2004, Czech government agreed lease of 14 Gripens (12 JAS 39Cs and two JAS 39Ds) between 2005 and 2015. Initial flight of Czech Gripen (actually fourth JAS 39C of contract, 39237) conducted on 18 October 2004; deliveries scheduled from 1 May 2005 and began with six aircraft to Caslav on 18 April, although formal acceptance delayed to 22 April; second six followed on 17/18 August 2005. First two-seater (9819) flew 21 April 2005 and both JAS 39Ds delivered 31 August 2005 to complete Czech contract. Gripen on QRA alert from 1 July 2005 onwards. Contract valued at CZK 19.65 billion. Aircraft have refuelling probes, OBOGS, colour cockpit displays with English language, NATO communications and weapons capability. Modified to carry AIM-9M-8/9 Sidewinder.

Hungary received Gripen proposal on 30 November 2000, this amended on 9 February 2001 with lease proposal; selected Gripen for air defence role on 10 September 2001, initially with lease of 14 aircraft (including two tandem-seat) for 10 years at cost of Ft130 billion to Ft140 billion. MoU signed 23 November 2001 and agreement finalised 20 December 2001 requiring initial deliveries in fourth quarter of 2004 and last in June 2005. However, negotiations reopened on 3 September 2002, following election of new Hungarian government. Parliamentary authorisation granted 10 March 2003, formalising agreement signed with Swedish Defence Material Administration on 3 February 2003 for lease/purchase of 12 single-seat ('30' to '41') and two tandem-seat ('42' and '43') aircraft with increased (multirole) capabilities, but at penalty of 2006 start to deliveries. Aircraft are remanufactured Swedish JAS 39A/BS, designated JAS 39 EBS HU; lease is 10 years (2006–2016), following which aircraft become property of Hungarian government. Modifications from Swedish standard include NATO standard communications, retractable refuelling probe, strengthened wings for LGB carriage and instrument calibration in Imperial units. Initial AAM is AIM-9L, with AIM-120 to follow. Assembly of first aircraft began 1 October 2004; formal rollout 25 January 2005; first flight ('30' c/n 39301) 16 February 2005. First two-seat flew 27 October 2005. Operating unit, 1st TFS, 59th TFW, based at Kecskemét where deliveries due between March 2006 and 2007, for 2008 IOC and 2010 declaration to NATO. First five aircraft delivered to Kecskemét on 21 March 2006; formal acceptance on 30 March.

Polish negotiations begun September 2001 in search for 60 new fighters. Final assembly of required 44 to 60 Polish Gripens would have been by PZL Aircraft Factory, under 1997 agreement, as covered by June 1999 proposal; however, revised offer of January 2001 restricted to five-year lease of 16 aircraft, including two trainers. Poland ordered Lockheed Martin F-16s in December 2002.

South Africa selected Gripen on 18 November 1998 for planned purchase of 28; order placed 15 September 1999 for nine two-seat Gripens, with option on further 19 of single-seat version; formal signature 3 December 1999, but first deliveries postponed at that time from 2002 to mid-2006. However, only one two-seat Gripen (c/n 39-2801) due in that year for trials (having entered final assembly on 11 January 2005), followed by remaining eight between November 2007 and September 2009. Initial JAS 39D (39-2801) rolled out 28 October 2005 and first flew 11 November 2005; shipped to South Africa mid-2006. Single-seat Gripens due between November 2009 and late 2011. Base will be Makhado.

Thailand showed interest in late 2004 in 20 ex-Swedish aircraft.

United Kingdom Empire Test Pilots' School at Boscombe Down detached students to Sweden from 1999 onwards to fly two-seat Gripen in company with Swedish safety pilot. In 2005, agreement extended for three years and requirement for local pilot was abandoned. In 2006, JAS 39B 39802 decorated with blue fin and ETPS badge.

COSTS: Planned cost of SEK25.7 billion in 1982, increased to SEK48.5 billion in 1991 by inflation; FMV has reported total cost increase of SEK9.3 billion for period 1982–2001; total budget SEK60.2 billion decided by Swedish Parliament 1993. SEK22.7 billion spent by 1 July 1993, including SEK14.5 billion to IG JAS. Up to SEK300 million approved late 1991 for JAS 39B development. Costs for 300-aircraft programme (subsequently reduced to 204) estimated in 1994 as SEK15 billion for development and SEK48 billion for production. South African purchase of 28 estimated programme cost R10.9 billion (US\$1.9 billion) (1998).

DESIGN FEATURES: Intended to replace AJ/SH/SF/JA/AJS versions of Saab Viggen, in that order, and remaining J 35 Drakens; to operate from 800 m (2,625 ft) Swedish V90 road strips; simplified maintenance and quick turnaround with ground crew comprising one technician and five conscripts.

By 2000, Gripen demonstrating 12 mmh/th; 7.6 hours MTBF readiness rate; and 10 minute turnaround in fighter configuration, 20 minutes in attack role. Targets are 10 mmh/th and 9.0 hours MTBF.



Saab JAS 39D Gripens over Castle Läckö, Sweden (Victor Veres)

1159327

Mid-mounted delta wing, with squared tips for missile rails, has three-section leading-edge, of which inboard and outboard sections sweptback at 55° and centre at 52°; foreplanes, independently movable, have leading-edge sweep of approximately 58°. Sweptback fin carries various antennas. Moderately high cockpit. Near-rectangular engine air intakes, each with splitter plate.

FLYING CONTROLS: BAE Systems (Lot 1) or Lockheed Martin SA11 (Lot 2) triplex fly-by-wire system with Moog electrically signalled servo valves on powered control units; Saab Combitech aircraft motion sensors and throttle actuator; mini-stick and HOTAS controls.

Leading-edge with dog-tooth and automatic flaps (one inboard/one outboard of dog-tooth, inner one outboard of canard) on Lucas Aerospace 'geared hinge' rotary actuators; two elevon surfaces at each trailing-edge; individual all-moving foreplanes, which also 'snowplough' for aerodynamic braking after landing; airbrake each side of rear fuselage.

STRUCTURE: Airframe is 60 per cent aluminium by weight, 6 per cent titanium and 5 per cent other metals; most of remainder is carbon fibre. First 3½ carbon fibre wing sets produced by BAE; all subsequent carbon fibre parts made by Saab, including wing boxes, foreplanes, fin and all major doors and hatches. BAE produces landing gear and, from 1999, responsible for assembly of centre fuselage for two-seat version, with single-seat to follow. Denel of South Africa contracted in 2000 to design and produce stores pylons for export Gripens. PZL-Mielec of Poland began delivering tailcones in late 2000. By 2002, late production JAS 39As had received additional 200 kg (441 lb) of strengthening to landing gear and wings for MTOW increase to 14,000 kg (30,864 lb) and service life increase from 3,000 to 4,000 hours.

LANDING GEAR: AP Precision Hydraulics retractable tricycle gear, single mainwheels retracting hydraulically forward into fuselage; steerable twin-wheel nose unit retracts rearward. Goodyear wheels. Carbon disc brakes and ABS anti-skid units. Nosewheel braking. Entire gear designed for high rate of sink. Mainwheel tyres 25.5x8.0-14 (16 ply); nosewheel 14x5.5-6 (8 ply).

POWER PLANT: One General Electric/Volvo Flygmotor RM12 (F404-GE-400) turbofan, rated initially at approximately 54 kN (12,140 lb st) dry and 80.5 kN (18,100 lb st) with afterburning. RM12UP version, in Lot 3 aircraft, incorporates FADEC, improved flame holder and redesigned turbine. Fuel in integral tanks in fuselage and wings. Intertechnique fuel management system; Dowty fuel health monitoring system for emergency (leak/battle damage) conservancy management. Optional FRL telescopic, retractable, hydraulically actuated in-flight refuelling probe mounted in port engine air intake; available on export aircraft and fitted to Swedish single-seat aircraft from 39207 (106th) onwards. External fuel carriage option of 1,136 litre (300 US gallon; 250 Imp gallon) EDTL (export drop tank, large).

ACCOMMODATION: Pilot only in JAS 39A/C, on Martin-Baker Mk 10L zero/zero ejection seat. Hinged canopy (opening sideways to port) and one-piece windscreen by Lucas Aerospace. Two seats in tandem in JAS 39B/D; command sequence in two-seat aircraft ejects rear occupant first, simultaneously inflating an airbag between the two cockpits to protect the rear pilot from Perspex splinters.

SYSTEMS: Hymatic environmental control system for cockpit air conditioning, pressurisation and avionics cooling. Hughes-Treidler heat exchanger. Two hydraulic systems, with Dowty equipment and Abex pumps. Hamilton Sundstrand main electrical power generating system (40 kVA constant speed, constant frequency at 400 Hz) comprises an integrated drive generator, generator control unit and current transformer assembly. Lucas Aerospace auxiliary and emergency power system, comprising gearbox-mounted turbine, hydraulic pump and 10 kVA AC generator, to provide auxiliary electric and hydraulic power in event of engine or main generator failure. In emergency role, the turbine is driven by engine bleed or APU air; if this is not available, the stored energy mode, using thermal batteries, is selected automatically. APU and air turbine starter for engine starting, cooling air and

standby electrical power. Original APU was Microturbo TGA15-090; changed to TGA15-328 from 40th JAS 39A and retrofitted to all in early second batch; Hamilton Sundstrand APU from 106th production single-seat aircraft (39207) and will be retrofitted. Optional OBOGS on export aircraft. Lot 3 Gripens have single Ericsson Saab Avionics GECU general electronic control unit, replacing previous three controllers for air, fuel and hydraulic systems.

AVIONICS: Service entry with E11 avionics software; upgraded via E12, E12.5 and E14 to E15 in 2001 and E15.1 (full AMRAAM and additional air-to-ground modes) in 2002.

Comms: CelsiusTech dual VHF/UHF transceivers and IFF in early aircraft; Rohde & Schwarz Series 6000 in third production lot and last 20 Lot 2 aircraft; option for installation in entire fleet; Series 6000 is element of tactical radio system (TARAS), providing secure communications via Data Link 39. Export aircraft to have Avionics (Grintek) GUS 1000 audio management system.

Radar: Ericsson/BAE PS-05/A multimode pulse Doppler target search and acquisition (lookdown/shootdown) radar (weight 156 kg; 344 lb). For fighter missions, system provides fast target acquisition at long range; search and multitarget track-while-scan; quick scanning and lock-on at short ranges; and automatic fire control for missiles and cannon. In attack and reconnaissance roles, operating functions are search against sea and ground targets; mapping, with normal and high resolution; and navigation. Upgrade with electronically scanned antenna is intended in 2010.

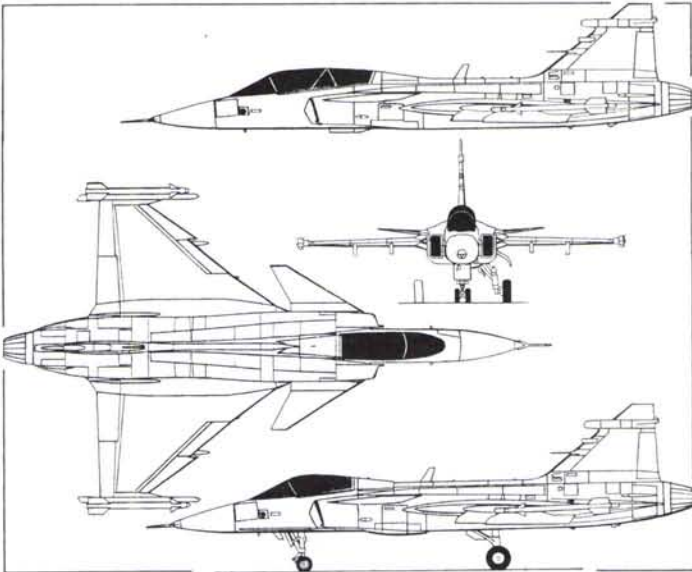
Flight: Ericsson SDS 80 central computing system (D80 computer, Pascal/D80 high-order language and programming support environment; upgraded D80E computer flown mid-1994 and introduced from 39108; D96 computer from 92nd single-seat aircraft, 39193); three MIL-STD-1553B databusses, one of which links flight data, navigation, flight control, engine control and main systems; Honeywell laser INS and radar altimeter; Nordmicro air data computer. BAE three-axis strapdown gyromagnetic unit provides standby attitude and heading information. Navigation data fusion in prospect via NINS (new integrated navigation system), under development by 1998; this to be followed by NILS (new integrated landing system) for autonomous Cat. I landing capability.

Instrumentation: Ericsson EP-17 electronic display system, incorporating Kaiser (Hughes in Lot 1) wide-angle HUD and using advanced diffraction optics to combine symbology and video images; display processor (replacing PP1 and PP2 in Lot 1) makes colour imagery possible; this facility is not required on Swedish Lot 2 aircraft, but colour capability introduced from 106th single-seat, 39207 (which will be regarded as sixth 'prototype' 39-6); three Ericsson CRT HDDs, each 120 x 150 mm (4¾ x 6 in), but 152 x 203 mm (6 x 8 in) MFID 68 active matrix LCDs in Lot 3. Left-hand (flight data) HDD normally replaces all conventional flight instruments; central display shows computer-generated map of area surrounding aircraft with tactical information superimposed; right-hand CRT is a multisensor display showing information on targets acquired by radar, FLIR and weapon sensors. Minimum of conventional analogue instruments for back-up only. Thales Guardian helmet-mounted display (HMD) undertook compatibility trials at Linköping in early 2001. BAE Systems and Cumulus of South Africa developing HMD for delivery with SAAF Gripens in 2007.

Mission: Rafael/Zeiss Optronik Litening targeting and navigation pod (Swedish designation PWS 39) under development in 2000 for carriage under starboard air intake trunk, forward of wing leading-edge, providing heat picture of target on right-hand HDD; first test flight, February 2003; trials complete by late 2004. IR-OTIS (a combined TRST and FLIR) under development by Saab Avionics for installation ahead of windscreen, slightly offset to port. CelsiusTech datalink shares information with up to four aircraft simultaneously. Contract for SEK600 million awarded to Saab in December 2001, for nine 680 kg (1,500 lb) Modular Airborne Reconnaissance System 39 (SPK 39) pods to be

SWAF JAS 39 CONTRACTS

Batch	Qty	Type	Serials	Remarks
Prototypes (5)	5	JAS 39	39-1 to 39-5	Plus 39-6 (below)
Lot 1 (30)	29	JAS 39A	39101 to 39129	39130 completed as JAS 39B
	1	JAS 39B	39800	
Lot 2 (110)	76	JAS 39A	39131 to 39206	
	14	JAS 39B	39801 to 39814	
	1	JAS 39C	39207/39-6	Testbed
	19	JAS 39C	39208 to 39226	Interim standard
Lot 3 (64)	50	JAS 39C	39227 to 39276	Including export diversions, of which 39224 to '245 to Czech Republic as 9234 to 9245
	14	JAS 39D	39815 to 39828	Including export diversions, of which 39819 and '820 to Czech Republic as 9819 and 9820
Total	209			



JAS 39A Gripen multirole combat aircraft for the Swedish Air Force, with additional side view (top) of two-seat JAS 39B (Dennis Punnett) 1159406

delivered from 2004 onwards and become operational in 2005 with F17 (four pods), F7 (two) and F21 (two). Programme delayed, and first flight not achieved (beneath JAS 39B 39800) until 24 March 2005; service postponed until 2006.

Vinten Vicon 70 Srs 72C modular reconnaissance pod available for export aircraft.

Self-defence: CelsiusTech RWR in early aircraft replaced by second-generation (Gen 2) version in 2000. CelsiusTech countermeasures, including chaff/flare and jamming. Saab EWS 39 electronic warfare suite ordered 1999 to replace existing system in Swedish aircraft, and is similar to export equipment; includes BOI 500 (BO2D) towed radar decoy under port wing, two pylon-mounted BOP 402 (BOP B) dispensers, laser warning system and missile approach warning.

ARMAMENT: Internally mounted 27 mm Mauser BK27 automatic cannon in port side of lower front fuselage (shoulder station 4P) and two wingtip-mounted Rb74 (AIM-9L) Sidewinder

IR AAMs (stations 1P and 1S) standard. (No internal gun in JAS 39B.) Six other external hardpoints (2P, 2S, 3P and 3S beneath wings, one on centreline and 4S below starboard air intake trunk). Maximum loads 110 kg (243 lb) each on 1P and 1S; 600 kg (1,323 lb) each on 2P and 2S; 1,300 kg (2,866 lb) each on 3P and 3S; 250 kg (551 lb) on 4S; and 1,100 kg (2,425 lb) on 5 (centreline). Weapons include short- and medium-range air-to-air missiles such as Rb74, MICA or Rb99 (AIM-120) AMRAAM; air-to-surface missiles such as Rb75 (Maverick); anti-shiping missiles such as Saab RBS 15F; DWS 39 (BK 90) munitions dispenser; KEPD 150 and KEPD 350 SOMs; conventional or retarded bombs; air-to-surface rockets; or external fuel tanks.

Swedish MoD contract of October 2001 covers integration of LGBs, of which GBU-10, -12 and -16 (and associated Mk 82, 83 and 84 bombs) cleared by mid-2004. AGM-65G Maverick trials began with inert carriage on 8 September 2004; AGM-65H and K to follow, along with AIM-9L/M and AIM-120B/C5. IRIS-T and Meteor AAM being integrated for Swedish AF. Meteor test firing first conducted 9 May 2006, following initial carriage of instrumented missile (by 39101) on 13 December 2005. New weapons under consideration for integration include Brimstone, MUPSOW standoff weapon and V-3E A-Darter AAM for South Africa. Agreement of June 2001 adds Rafael weapons to potential armoury, initially Python 4 AAM and Spice guided bomb. Saab Aerosystems commissioned in November 2003 to integrate Meteor AAM.

DIMENSIONS, EXTERNAL:

Wing span, incl missile rails	8.40 m (27 ft 6¾ in)
Length, excl pitot tube: JAS 39A	14.10 m (46 ft 3 in)
JAS 39B	14.755 m (48 ft 5 in)
Height overall	4.50 m (14 ft 9 in)
Wheel track	2.40 m (7 ft 10½ in)
Wheelbase: JAS 39A	5.20 m (17 ft 0¾ in)
JAS 39B	5.90 m (19 ft 4¼ in)

WEIGHTS AND LOADINGS:

Operating weight empty: JAS 39A	6,622 kg (14,600 lb)
JAS 39C	approx 6,820 kg (15,036 lb)
JAS 39B	8,000 kg (17,637 lb)
Internal fuel weight	2,268 kg (5,000 lb)
T-O weight, clean	approx 8,500 kg (18,740 lb)
Max T-O weight with external stores:	
R12 software	12,500 kg (27,557 lb)
R14 software	14,000 kg (30,864 lb)

PERFORMANCE:

Min flying speed	less than 100 kt (185 km/h; 115 mph)
Max level speed	supersonic at all altitudes
T-O and landing strip length	approx 800 m (2,625 ft)
Combat radius	approx 432 n miles (800 km; 497 miles)
g limit	+9

Switzerland

INTRACOM

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 PRESIDENT AND CEO: David Schmidt

Intracom, formed in 1994, is an international company with diverse interests in aircraft design, engineering, transport, travel, ecology and development of new technologies. It joined with the Khronichev company of Russia to offer the GM-17 light transport in Western markets but, in November 2001, it formed a new alliance with Technoavia, and its associated SmAZ production plant. The GM-17 had its public debut at MAK'S '03, Moscow, in August 2003.

It is planned to produce a diverse family of closely related aircraft, including DS-2 turboprop trainer/light attack aircraft and DS-12 light utility turboprop, which will mark a break away from collaboration with Russia and is expected to be a wholly Western European/Swiss venture.

AEROTECH (INTRACOM) SMG-92T TURBO FINIST

TYPE: Light utility turboprop.

PROGRAMME: Developed from Smolensk (Technoavia) SM-92 Finist by Aerotech of Bratislava, Slovakia, with emphasis on sport parachutist dropping; commissioned and financed by G-92 Commerce Ltd, of Nagybanai 61, H-1025 Budapest, Hungary (e-mail: budata@euroweb.hu). Work began in early 2000, with first flight (newly built aircraft, HA-YDF) 7 November 2000; Hungarian type certificate awarded 14 December 2000; delivery to Wingglider Ltd in UK, January 2001. Second conversion, HA-YDG, produced from RA-44485, exhibited at Aero '01, Friedrichshafen, April 2001, and stationed with Skydive Center, Bad Saulgau, Germany, from June 2001. In parallel, M601-powered Finists have been produced by Smolensk plant in Russia, designated SM-92T. Total of four completed by end February 2003 (excluding conversion of prototype); programme then transferred to Intracom for further marketing, beginning 2004. Three produced under Intracom by early 2006, including one to operator in Poland and one, in May 2006, to Russian police.

Airframe and engine mounting produced by SmAZ at Smolensk; engine installation and cowling, parapod step and handrails in vicinity of cabin door, new electrical system, instrument panel and engine controls by Aerotech.

POWER PLANT: One 400 kW (536 shp) Walter M 601D-2 turboshaft, driving an Avia V-508D-2 three-blade, fully feathering, reversible-pitch propeller. Optional ferry tank. Offered by Intracom with alternative Rolls-Royce 250 or P&WC PT-6 turboprop.



Aerotech (Intracom) SMG-92T Turbo Finist

1159005

ACCOMMODATION: Pilot and 10 parachutists; alternatively, pilot and up to seven passengers on lightweight seats.

Data generally as for Smolensk SM-92 Finist, except that below.

DIMENSIONS, EXTERNAL:

Length overall 9.925 m (32 ft 6¾ in)

Wheelbase 6.59 m (21 ft 7½ in)

WEIGHTS AND LOADINGS:

Weight empty 1,450 kg (3,197 lb)

Max T-O weight: paradrop 2,700 kg (5,952 lb)

passenger 2,350 kg (5,180 lb)

Max landing weight 2,350 kg (5,180 lb)

PERFORMANCE:

Never-exceed speed (VNE) 164 kt (305 km/h; 189 mph)

Max operating speed (VMO) 143 kt (265 km/h; 165 mph)

Max level speed at 915 m (3,000 ft) 159 kt (295 km/h; 183 mph)

Cruising speed 130 kt (240 km/h; 149 mph)

Stalling speed, engine off:

flaps up 63 kt (115 km/h; 72 mph)

flaps down 54 kt (100 km/h; 63 mph)

Max rate of climb at S/L 457 m (1,500 ft)/min

Time to 4,000 m (13,120 ft) 11 min

Descent from 4,000 m (13,120 ft) 5 min 30 s

Max operating altitude 5,940 m (19,500 ft)

T-O run 250 m (820 ft)

T-O to 15 m (50 ft) 457 m (1,500 ft)

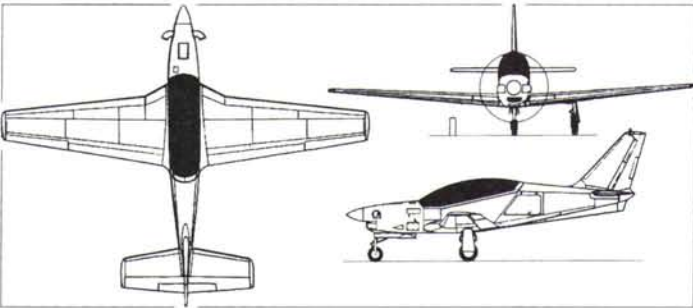
Landing run 280 m (920 ft)

Landing run with propeller reversal 145 m (475 ft)

Max range with optional fuel 324 n miles (600 km; 372 miles)

INTRACOM DS-2

PROGRAMME: Design of a two-seat turboprop trainer is in preliminary stage at Intracom's office. Overall details are evident in the general arrangement drawing.



Intracom DS-2 (894 kW; 1,200 shp turboprop) 1128985

INTRACOM DS-12

TYPE: Light utility turboprop.

PROGRAMME: Initially designated DS-112 when announced in 2004; design then revised, including sweptback fin, replacing unswept unit, and changes to dimensions. Construction of prototype was due to have begun in 2006.

DESIGN FEATURES: High-mounted, constant-chord wing with rounded tips; mid-mounted tailplane; sweptback fin with ventral fillet. Employs some systems of GM-17 Viper to achieve reduced cost.

Wing section P-301M-15%; dihedral 2°; incidence 3°; twist -2°. Tailplane section NACA 23010 reversed.

FLYING CONTROLS: Conventional and manual. Flaps. Trim tab in port elevator, rudder and starboard aileron. Control surface movements: ailerons +25/-10°; elevators +20/-26°; rudder ±25°; flaps 20 and 40°.

STRUCTURE: Generally of metal.

LANDING GEAR: Tailwheel type; fixed.

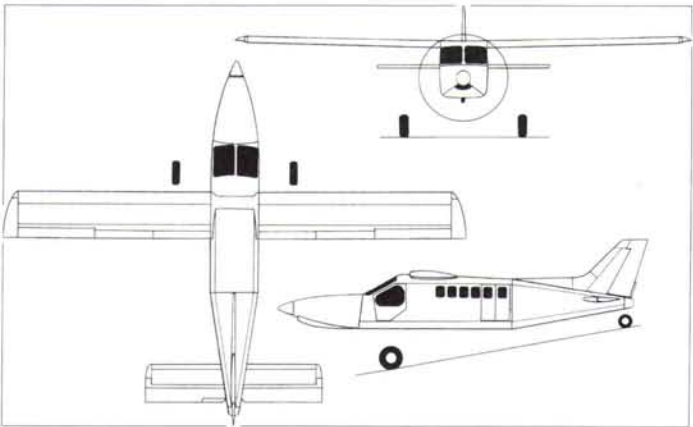
POWER PLANT: One 560 kW (757 shp) Walter M601F (or M601E) turboprop. Normal internal fuel capacity 820 litres (217 US gallons; 180 Imp gallons); provision for additional 400 litres (106 US gallons; 88.0 Imp gallons) ferry fuel in nose baggage hold.

ACCOMMODATION: Eleven persons, including pilot(s), to FAR Pt 23; alternatively 15 persons. Cockpit door each side; passenger/freight door both sides.

DIMENSIONS, EXTERNAL:

Wing span 16.85 m (55 ft 3½ in)

Wing chord (constant) 1.40 m (4 ft 7 in)



Representative diagram of DS-12 utility turboprop, proportions not conforming to most recent specification (Paul Jackson) 1128984

Wing aspect ratio 11.9

Length overall 13.40 m (43 ft 11½ in)

Height overall 3.58 m (11 ft 9 in)

Tailplane span 5.53 m (18 ft 1¾ in)

Wheel track 4.55 m (14 ft 11¼ in)

Wheelbase 7.65 m (25 ft 1¼ in)

Propeller diameter 2.50 m (8 ft 2½ in)

Propeller ground clearance 0.80 m (2 ft 7½ in)

Passenger doors (combined): Height 1.20 m (3 ft 11¼ in)

Width 1.55 m (5 ft 1 in)

Cockpit doors (each): Height 1.20 m (3 ft 11¼ in)

Width 1.05 m (3 ft 5¼ in)

DIMENSIONS, INTERNAL:

Accommodation:

Length: between bulkheads 8.58 m (28 ft 1¾ in)

cockpit 1.68 m (5 ft 6¼ in)

passenger cabin 3.68 m (12 ft 1 in)

Max width 1.39 m (4 ft 6¾ in)

Max height 1.65 m (5 ft 5 in)

AREAS:

Wings, gross 23.80 m² (256.2 sq ft)

Ailerons (total) 3.05 m² (32.83 sq ft)

Flaps (total) 4.20 m² (45.21 sq ft)

Fin 3.96 m² (42.63 sq ft)

Rudder 1.76 m² (18.94 sq ft)

Tailplane 6.64 m² (71.47 sq ft)

Elevators (total, incl tabs) 3.00 m² (32.29 sq ft)

WEIGHTS AND LOADINGS:

Weight empty 1,730 kg (3,814 lb)

Max payload 1,500 kg (3,307 lb)

Max normal fuel weight 656 kg (1,446 lb)

Max T-O weight 3,500 kg (7,716 lb)

Max wing loading 147.1 kg/m² (30.12 lb/sq ft)

Max power loading 6.20 kg/kW (10.19 lb/shp)

PERFORMANCE (estimated):

Max level speed 165 kt (305 km/h; 190 mph)

Cruising speed 154 kt (285 km/h; 177 mph)

Econ cruising speed: low level 103 kt (190 km/h; 118 mph)

high level 119 kt (220 km/h; 137 mph)

Stalling speed: flaps up 60 kt (110 km/h; 69 mph)

flaps down 52 kt (95 km/h; 59 mph)

Max rate of climb at S/L 570 m (1,870 ft)/min

Time to FL131 11 min

Descent from FL131 5 min

Max certified altitude 6,000 m (19,680 ft)

T-O run 270 m (885 ft)

T-O to 15 m (50 ft) 460 m (1,510 m)

Landing run with propeller reversal 175 m (575 ft)

Range, 40 min reserves:

max normal fuel and 430 kg (948 lb) payload:

low altitude: max cruise 405 n miles (750 km; 466 miles)

econ cruise 459 n miles (850 km; 528 miles)

FL197: max cruise 618 n miles (1,145 km; 711 miles)

econ cruise 718 n miles (1,330 km; 826 miles)

ferry at FL197: normal fuel 853 n miles (1,580 km; 981 miles)

ferry fuel 1,166 n miles (2,160 km; 1,342 miles)

Endurance, normal fuel 8 h

INTRACOM GM-17 VIPER

TYPE: Light utility turboprop.

PROGRAMME: Designed within Khronichev bureau in Moscow by Evgeny P Grunin. Considerably modified Piper PA-31P Pressurised Navajo (PA-31T version also suitable for conversion).

Intracom had previously proposed a collaborative project with Piper, to be known as PA-31TXL, but this was rejected by the US company.

First flight (GM-17-000, registered RA-01559; the former N38RG) 6 December 2000; 10 sorties and 6 hours flown by February 2001, when laid-up for static testing. Further two prototypes were to have followed in 2001, using Navajos G-OIEA and SE-IGB as basis; programme delayed by change of partner company to Technoavia (chief designer



Cockpit of Intracom GM-17 Viper No.5 1159026



1159025

Vyatcheslav Kondratiev) in November 2001 and renaming of aircraft from Femks (Phoenix) to Viper. Khronichev prototype transferred to SmAz at Smolensk for disassembly and rebuild; changes included replacement of winglets by tip tanks and revised nose contours; reflight January 2003 as GM 17-000; flew 60 hours before relegation to static testing in April 2003. Three PA 31P airframes (GM-17-001, 002 and 003) delivered to SmAz in November 2001 and entered modification: GM 17-001/RA-44471 flown March 2003 and accumulated 62 hours in first three months, Russian demonstrator and exhibition at Moscow in August 2003; GM 17-002 (RA-3042K) and GM 17-003 (RA-3043K) scheduled for August 2003 first flight and initial customer delivery in October 2003. GM 17-003 as European demonstrator, fitted with enlarged wingtip pods containing radar (starboard) and landing light. GM-17-004 (EX-051) delivered March 2004; GM 17-005 (EX-053) new demonstrator; GM-17-006 (EX-052) early 2006 delivery.

Intended conversion of further 24 aircraft between 2006 and 2009, when new version of GM-17 will be available. All 30 initial aircraft to have Experimental category certification. However, in early 2004 Technoavia withdrew from the project because of a financial dispute. New design authority appointed, in form of Aerotech of Bratislava, Slovakia, this replaced in 2006 by DASH of Switzerland.

costs: USD680,000 to USD860,000 (2006).

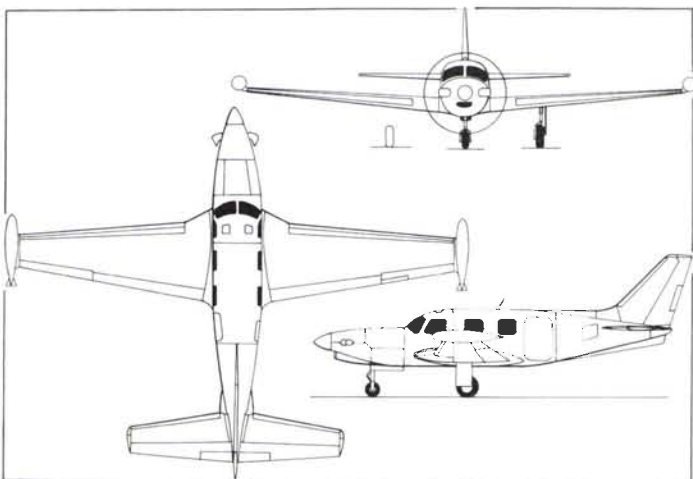
DESIGN FEATURES: Single-engined turboprop for passenger and light freight transport; suitable for executive ferry, medical evacuation, patrol, geological survey and training.

Low-mounted, tapered wing with wingtip tanks or winglets; mid-positioned, tapered tailplane and sweptback fin.

Wing section NACA 63-415 at root; 63-212 at tip; leading-edge sweepback 5°; thickness chord ratio 14 per cent at root, 12 per cent at tip; dihedral 5°; incidence 1° 30'; twist -2° 30'. Tailplane incidence 2°; wingroot rib sweepback 28°.

FLYING CONTROLS: Conventional and manual. Trim tab in starboard aileron, rudder and both elevators. Flap settings 20° for take off; 40° for landing. Aileron deflections +24°/-14°; rudder $\pm 35^\circ$; elevators +16°/-20°.

STRUCTURE: Ali retained the airframe and landing gear components overhauled before reassembly. Revised structure includes fireproof steel bulkhead (Frame 3) behind engines; new engine cowling forward of Frame 4; replacement wing panels in former engine positions; tailplane root fillets; new window frames; ventral fin; revised tailplane incidence (+2°, replacing -2°); composites fintip; replaced fuel tanks and lines, oil system, electrical system (retaining some PA-31 parts), fire warning system and hydraulic system, de-icing system and oxygen system (reduced capacity).



1128983

LANDING GEAR: Tricycle type; hydraulically actuated; mainwheels retract inward; nosewheel rearward; single wheel on each unit. Nosewheel steerable $\pm 28^\circ$; free casting angle $\pm 80^\circ$. Goodyear mainwheels and 6.50-10 (8 ply) tyres; Cleveland nosewheel with 6.00-6 (8 ply) tyres. Hydraulic brakes.

POWER PLANT: One 560 kW (757 shp) Walter M 601E turboprop, driving a five-blade VS10 constant-speed, fully reversing propeller. (GM 12-000 and 001 have M 601D engine and VS08E/99 three blade propellers). Total fuel capacity 1,025 litres (271 US gallons; 225 Imp gallons) in wing tanks. Optional wingtip tanks of Piper design 125 litres (33.0 US gallons; 27.5 Imp gallons) each. Max fuel 1,275 litres (337 US gallons; 280 Imp gallons).

ACCOMMODATION: Two pilots and six passengers; forward four passengers in club arrangement; lavatory and baggage area at rear. Externally accessed baggage compartment in nose. Single door, port, rear. Emergency exit, starboard. Cabin protected by up to 25 mm (1 in) of soundproofing material. Accommodation pressurised and air-conditioned. Emergency oxygen masks.

SYSTEMS: Hydraulic system, pressure 150 bar (2,175 lb/sq in); 27 V electrical system; emergency oxygen. De-icing system on all leading-edges; pneumatic on initial aircraft, but alcohol or electrical system for future installation.

AVIONICS: *Comm:* Garmin GMA 430 intercom, GNS 430 and GNS 530 VHF/NAV, each with GL 106 indicator, SG 2000 HF transceiver, Twin Garmin GTX 327 transponders, C406-1 ELT.

Radar: Optional Bendix/King RDR 2000 weather radar in pod on starboard wing.

Flight: Bendix/King KR 87 radio compass, KI 227 ADF indicator, MT Ultra moving map and S Tec 55 autopilot.

EQUIPMENT: Four landing lights as standard; further optional light in wingtip tanks, if fitted.

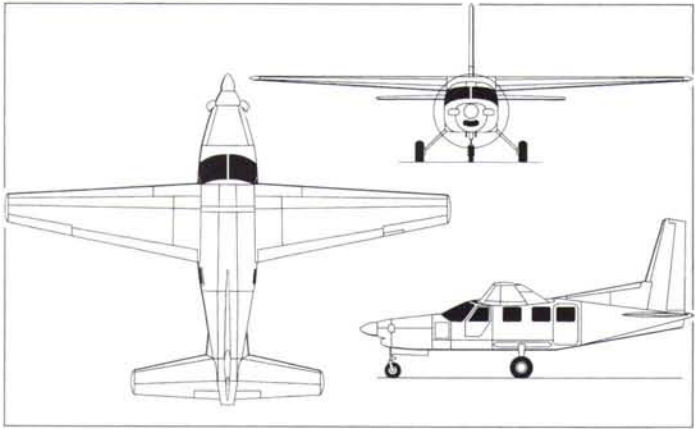
DIMENSIONS, EXTERNAL:

DIMENSIONS, EXTERNAL	
Wing span over optional tanks	13.04 m (42 ft 9½ in)
Wing chord: at root	2.28 m (7 ft 5¾ in)
at tip	0.985 m (3 ft 2¾ in)
Wing aspect ratio	5.4
Length: overall	10.56 m (34 ft 7¾ in)
fuselage	9.64 m (31 ft 7½ in)
Fuselage: Max width	1.44 m (4 ft 8¾ in)
Max height	1.625 m (5 ft 4 in)

Height overall	4.075 m (13 ft 4½ in)
Tailplane span	6.045 m (19 ft 10 in)
Tailplane chord	1.155 m (3 ft 9½ in)
Wheel track	4.19 m (13 ft 9 in)
Wheelbase	2.63 m (8 ft 7½ in)
Propeller diameter	2.50 m (8 ft 2½ in)
Propeller ground clearance	0.30 m (11¾ in)
Passenger door: Height	1.32 m (4 ft 4 in)
Width	0.78 m (2 ft 6¾ in)
Emergency exit: Height	0.55 m (1 ft 9¾ in)
Width	0.41 m (1 ft 4¼ in)
Nose baggage door: Height	1.20 m (4 ft 8¾ in)
Width	0.70 m (2 ft 3½ in)
DIMENSIONS, INTERNAL:	
Cabin (incl flight deck and baggage):	
Length	4.40 m (14 ft 5¼ in)
Max width	1.32 m (4 ft 4 in)
Max height	1.32 m (4 ft 4 in)
Baggage hold volume: cabin	0.62 m³ (22 cu ft)
nose	0.42 m³ (15 cu ft)
AREAS:	
Wings, gross	31.30 m² (336.9 sq ft)
Ailerons (total)	1.235 m² (13.29 sq ft)
Trailing-edge flaps (total)	3.135 m² (33.74 sq ft)
Winglets (total)	2.86 m² (30.78 sq ft)
Fin	2.60 m² (27.99 sq ft)
Rudder (incl tab)	0.865 m² (9.31 sq ft)
Tailplane	6.72 m² (72.33 sq ft)
Elevators (total)	2.45 m² (26.37 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	1,756 kg (3,871 lb)
Max T-O and landing weight	3,300 kg (7,275 lb)
Max payload	1,000 kg (2,205 lb)
Max wing loading	105.4 kg/m² (21.59 lb/sq ft)
Max power loading	5.85 kg/kW (9.61 lb/shp)
PERFORMANCE:	
Max level speed	232 kt (430 km/h; 267 mph)
Normal cruising speed	221 kt (410 km/h; 254 mph)
Econ cruising speed	140 kt (260 km/h; 162 mph) IAS
Stalling speed, flaps down	67 kt (123 km/h; 77 mph)
Max rate of climb at S/L	426 m (1,398 ft)/min
Service ceiling	7,165 m (23,500 ft)
T-O run	460 m (1,510 ft)
Landing run with propeller reversal	340 m (750 ft)
Range with tip tanks, 40 min reserves:	
high speed, low altitude	674 n miles (1,250 km; 776 miles)
at FL195, 205 kt	1,295 n miles (2,400 km; 1,491 miles)
ferry	1,598 n miles (2,960 km; 2,409 miles)
Endurance, absolute	7 h 50 min

INTRACOM GM-19

TYPE: Light utility turboprop.
PROGRAMME: Construction of prototype was to begin in 2004.
DESIGN FEATURES: Wings and empennage of Piper PA-31 married to new fuselage, but incorporating systems already employed in GM-17 Viper for simplicity, low risk and minimum cost. High-mounted, tapered wing; mid-mounted, tapered tailplane; and fin with large fillet.
FLYING CONTROLS: Conventional and manual. Trim tabs in elevator, starboard aileron and rudder.
STRUCTURE: Generally of metal.
POWER PLANT: One 560 kW (757 shp) Walter M 601E turboprop. Fuel capacity 1,220 litres (322 US gallons; 268 Imp gallons).



Provisional general arrangement of Intracom GM-19 (Paul Jackson)

ACCOMMODATION: Crew door each side; main door to port, with emergency exit opposite.
SYSTEMS: Generally as for GM-17 Viper.
AVIONICS: Generally as for GM-17 Viper.

DIMENSIONS, EXTERNAL:

Wing span	13.92 m (45 ft 8 in)
Wing aspect ratio	7.8
Length overall	10.46 m (34 ft 3½ in)
Height overall	4.84 m (15 ft 10½ in)
Tailplane span	6.045 m (19 ft 10 in)
Wheel track	3.40 m (11 ft 1½ in)
Wheelbase	3.94 m (12 ft 11 in)
Propeller diameter	2.30 m (7 ft 6½ in)
Main door: Height	1.65 m (5 ft 5 in)
Width	1.20 m (3 ft 11¼ in)

DIMENSIONS, INTERNAL:

Cabin (incl cockpit): Length	5.20 m (17 ft 0¾ in)
Max width	1.30 m (4 ft 3¼ in)
Max height	1.65 m (5 ft 5 in)

AREAS:

Wings, gross	24.8 m² (266.9 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	1,400 kg (3,086 lb)
Max payload	1,400 kg (3,086 lb)
Max fuel weight	976 kg (2,151 lb)
Max T-O weight	3,500 kg (7,716 lb)
Max wing loading	141.1 kg/m² (28.91 lb/sq ft)
Max power loading	6.20 kg/kW (10.19 lb/shp)

PERFORMANCE:

Max cruising speed	194 kt (360 km/h; 224 mph)
Stalling speed, power off:	
flaps up	67 kt (123 km/h; 77 mph)
flaps down	59 kt (109 km/h; 68 mph)
Max rate of climb at S/L	570 m (1,870 ft)/min
T-O run	330 m (1,085 ft)
Landing run with propeller reversal	230 m (755 ft)
Range:	
with max fuel	1,436 n miles (2,660 km; 1,652 miles)
with max payload	944 n miles (1,750 km; 1,087 miles)
Endurance	8 h

LIGHTWING

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CEO: Marco Trüssel
TECHNICAL DIRECTOR: Alois Amstutz
DESIGNER: Hans Gygax

Having designed what is now marketed as the Ikarus C 42, Hans Gygax produced a slightly larger, utility version. This is marketed by Light Wing Aircraft AG, which was formed in September 2000 to seek launch funding for large-scale production in several applications, particularly glider towing. Manufacture is proceeding at low rate at Buochs aerodrome.

LIGHTWING AC4

TYPE: Two-seat lightplane.
PROGRAMME: Prototype first flew June 1998. Second prototype (of three) shown, substantially complete, at Aero '03, Friedrichshafen, April 2003. First production aircraft (c/n 04, registered 17-JH) awarded French certification 16 February 2005.
CURRENT VERSION: **AC4:** Baseline version; as described. Capabilities include touring and medical evacuation.
AC4 Schlepp: Glider tug; 93.2 kW (125 hp) turbocharged Rotax 914. Rate of climb, laden, 300 m (984 ft)/min.
AC4 SPC: US Sport Plane Class (LSA); otherwise as baseline AC4.
AC8: Light transport ("air van"); under development by 2003.
DESIGN FEATURES: Meets Swiss 'EcoLight' category requirements for 560 kg (1,234 lb) MTOW; certifiable to JAR requirements. High wing with V-strut bracing; tailplane braced to fin.



Lightwing AC4 prototype

1158832

FLYING CONTROLS: Conventional and manual. Flaps. Flight-adjustable trim tab on port elevator.
STRUCTURE: Glass fibre fuselage built around full-length, large diameter, circular section metal boom. Metal tailplane, elevators, fin and rudder, with composites tips; metal wing, flaps and ailerons, with composites, upturned wingtips.
LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring cantilever mainwheel legs with wheel fairings; steerable nosewheel with wheel fairing.
POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS flat-four driving a Warp Drive three-blade, carbon fibre, fixed-pitch propeller via 1:2.4 reduction gearing; 84.5 kW (113.3 hp) Rotax 914 F optional. Optional Neuforn ground-adjustable propeller on first production aircraft. Fuel capacity 100 litres (26.4 US gallons; 22.0 Imp gallons).
ACCOMMODATION: Two persons, side-by-side; large stowage space behind seats. Broad, upward-hinged door each side.
EQUIPMENT: Optional retractable towing line in rear fuselage.
DIMENSIONS, EXTERNAL:

Wing span	9.60 m (31 ft 6 in)
Wing aspect ratio	7.3



Large door of Lightwing AC4 allows carriage of stretcher for medical evacuation 1158833

MSW

MSW AVIATION

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 Web: www.mswaviation.com
 PRESIDENT: Max Vogelsang

MSW Aviation was formed in 1991. Its latest product is the Votec 351, a single-seat version of the Votec 322 kitbuilt aerobatic two-seater. Construction assistance offered to builders at new 250 m² (2,691 sq ft) facility opened in October 2004 at Birrfeld airfield, near company headquarters. Similar facility available at Schwäbisch Hall in southern Germany.

MSW VOTEC 322

TYPE: Tandem-seat sportplane kitbuilt.
 PROGRAMME: Designed by Max Vogelsang; name indicates Vogelsang Technik, 320 hp, 2 seats. Inspired by, and derived from, DR 107 One Design single-seater, one of which acquired by MSW and flown as HB-YJM. Prototype Votec 322 (HB-YJY) made first flight 6 April 2001 and public debut at Friedrichshafen Air Show later that month. Certified by Swiss FOCA.
 CUSTOMERS: Sixth aircraft made initial flight on 26 May 2006. Customers in Austria, Germany and Switzerland.
 COSTS: Kit EUR155,000 basic, excluding engine, propeller and instruments (2003).
 DESIGN FEATURES: Low-wing monoplane with symmetrical aerofoil section and angular flying surfaces. Available only as a kit, but MSW provides factory-based builder's assistance programme.
 FLYING CONTROLS: Conventional and manual. Near full-span ailerons; horn-balanced rudder and elevators; in-flight-adjustable trim tab in each elevator.
 STRUCTURE: Welded 4130 steel tube fuselage main frame; plywood-covered wooden wings; carbon fibre wing skin, fuselage skin and tail unit.
 LANDING GEAR: Tailwheel type; fixed. Fuselage-mounted spring cantilever mainwheel legs with wheel fairings; steerable tailwheel. Mainwheel speed fairings.
 POWER PLANT: One 246 kW (330 hp) Textron Lycoming AEIO-540 flat-six engine, driving an MT-Propeller MTV-14 four-blade constant-speed propeller. Fuel in integral 43 litre (11.4 US gallon; 9.5 Imp gallon) tank in each wingroot, plus 110 litre (29.1 US gallon; 24.2 Imp gallon) fuselage tank; total capacity thus 196 litres (51.9 US gallons; 43.2 Imp gallons).
 ACCOMMODATION: Two persons in tandem under one-piece canopy which opens sideways to starboard.
 AVONICS: Described as 'glass cockpit' standard.



MSW Votec 322 built by Rolf Stalder made its first flight at Birrfeld, Switzerland, on 26 May 2006 (Rolf Stalder)

Length overall	6.95 m (22 ft 9½ in)
Height overall	2.30 m (7 ft 6½ in)
DIMENSIONS, INTERNAL:	
Cabin: Length	1.90 m (6 ft 2¾ in)
Max width	1.27 m (4 ft 2 in)
AREAS:	
Wings, gross	12.70 m ² (136.7 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	300 kg (661 lb)
Max T-O weight	560 kg (1,234 lb)
Max wing loading	44.1 kg/m ² (9.03 lb/sq ft)
Max power loading	7.62 kg/kW (12.52 lb/hp)
PERFORMANCE:	
Never-exceed speed (VNE)	113 kt (210 km/h; 130 mph)
Cruising speed at 75% power	100 kt (185 km/h; 115 mph)
Stalling speed, power off, flaps down	34 kt (63 km/h; 40 mph)
Max rate of climb at S/L	439 m (1,440 ft)/min
T-O run	92 m (300 ft)
Landing run	98 m (320 ft)
Range with max fuel	675 n miles (1,250 km; 776 miles)
g limits	+4/-2

DIMENSIONS, EXTERNAL:	
Wing span	7.30 m (23 ft 11½ in)
Length overall	6.50 m (21 ft 4 in)
Height overall	2.50 m (8 ft 2½ in)
Propeller diameter	1.95 m (6 ft 4¾ in)
AREAS:	
Wing area	10.50 m ² (113.0 sq ft)
Ailerons (total)	1.50 m ² (16.15 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	630 kg (1,389 lb)
Max T-O weight	950 kg (2,094 lb)
Max wing loading	90.5 kg/m ² (18.53 lb/sq ft)
Max power loading	3.86 kg/kW (6.34 lb/hp)
PERFORMANCE:	
Never-exceed speed (VNE)	220 kt (407 km/h; 253 mph)
Max cruising speed	174 kt (322 km/h; 200 mph)
Stalling speed	55 kt (102 km/h; 64 mph)
Max rate of climb at S/L	1,036 m (3,400 ft)/min
Max rate of roll	420°/s
T-O run	112 m (370 ft)
Landing run	350 m (1,150 ft)
Range	750 n miles (1,389 km; 863 miles)
Endurance	3 h
g limits	±10

MSW VOTEC 351

TYPE: Single-seat sportplane kitbuilt.
 PROGRAMME: Introduced 2006; maiden flight of prototype (HB-YMV) 23 September 2006.
 DESIGN FEATURES: Single-seat derivative of Votec 322; rudder area reduced to 1.50 m² (16.15 sq ft).
 POWER PLANT: One 261 kW (350 hp) Textron Lycoming AEIO-580; propeller as for Votec 322. Fuselage fuel tank as Votec 322, wing tanks reduced to 40 litres (10.6 US gallons; 8.8 Imp gallons) each, hence total capacity 180 litres (47.6 US gallons; 39.6 Imp gallons).
 DIMENSIONS, EXTERNAL:
 As Votec 322
 WEIGHTS AND LOADINGS:
 Weight empty 580 kg (1,279 lb) || Max T-O weight | 830 kg (1,829 lb) |
| Max wing loading | 79.05 kg/m² (16.19 lb/sq ft) |
| Max power loading | 3.18 kg/kW (5.23 lb/hp) |

PERFORMANCE:

Never-exceed speed (VNE)	234 kt (434 km/h; 270 mph)
Max cruising speed	174 kt (322 km/h; 200 mph)
Stalling speed	57 kt (105 km/h; 65 mph)
Max rate of climb at S/L	1,067 m (3,500 ft)/min

Max rate of roll	420°/s
T-O run	110 m (360 ft)
Landing run	350 m (1,150 ft)
g limits	±12

PICCARD

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In 2003, Bertrand Piccard initiated the Solar Impulse project, the main objective of which is to make a round-the-world flight in five-day stages in an aircraft powered entirely by solar energy. An associate in the project is Brian Jones, Piccard's co-pilot in the 1999 round-the-world flight of the *Breitling Orbiter 3* balloon.

PICCARD SOLAR IMPULSE

TYPE: Technology demonstrator.
PROGRAMME: Announced 28 November 2003. Original timetable was for first prototype to be designed and built 2004-05; first flight planned for early 2006; milestone of 36-hour flight, including complete night in the air, targeted for 2007. Second prototype to fly at end of that year; ultra-long-distance and duration flights planned from then on, leading to round-the-world attempt in 2009. Swiss Federal Institute for Technology (EPFL) will supply an engineer/pilot and act as scientific partner, following a feasibility study which began in March 2003. However, revised schedule announced in 2005 indicated first flight now targeted for 2008 and trans-global flight for 2011.
Presentation to international media at Paris Air Show on 13 June 2005 included one-twentieth scale display model and news that 25 per cent of estimated EUR40 million

had been allocated by then. Financial and technological partners were named as Solvay SA of Belgium (R&D resources), Altran Technologies SA of France (engineering) and Dassault Aviation (aeronautical design adviser). Swiss watchmaking company Omega became a principal partner in May 2006, taking total financing past the 50 per cent mark. In same year, BKW FMB Energie and Sputnik Engineering (SolarMax) were named as service suppliers. In addition, the European Space Agency is providing expertise from within the framework of its technology transfer programme.

Global flight will start by charging batteries from solar power, to provide power for take-off before dawn the following morning from a high-sun location (UAE or New Mexico have been suggested as possibilities). Aircraft would reach maximum altitude shortly after noon, then descend slowly to lower altitude as solar radiation decreases during the afternoon and reverting to battery power for continued flight during the night. Travel will be between latitudes 10 and 30° in the northern hemisphere for maximum air time over land.

In addition to achieving the flight itself, the venture aims to exploit and develop solar energy technology to make it possible for an aircraft to sustain very long-term flight without the use of any kind of embarked fossil fuel and without emitting any pollutants. It defines sustainable development as "the ability of present generations to provide for their own needs without jeopardising the ability of future generations to provide for theirs".

In mid-2006, Altran was modelling a simulated long-distance flight between Dubai and China as part of the development programme.

DESIGN FEATURES: Aircraft has the general configuration of a high aspect ratio, T-tailed sailplane, with the entire wing and tailplane upper surfaces covered in solar cells.

Following data all provisional:

POWER PLANT:	Twin 14.9 kW (20 hp) battery-powered electric motors, each driving a two-blade propeller. Batteries housed in four underwing pods.
ACCOMMODATION:	Two-person, underslung pod, pressurised to 0.50 bar (7.3 lb/sq in).
DIMENSIONS, EXTERNAL:	
Wing span	80 m (262.5 ft)
AREAS:	
Solar cell area	250 m ² (2,691 sq ft)
WEIGHTS AND LOADINGS:	
Lithium ion batteries (total)	400 kg (882 lb)
Max T-O weight	2,000 kg (4,409 lb)
PERFORMANCE:	
Cruising speed: at high altitude (day)	54 kt (100 km/h; 62 mph)
at low altitude (night)	27 kt (50 km/h; 31 mph)
Stalling speed	19 kt (36 km/h; 22 mph) IAS
Cruising height range: upper	12,200 m (40,000 ft)
lower	3,050 m (10,000 ft)

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In December 1998, as part of a move to dispose of its aerospace activities, Oerlikon-Bührle (now renamed OC Oerlikon) revealed that it was seeking a buyer for Pilatus. New owners were named on 1 March 2001 as a consortium comprising Jörg Burkart, IHAG Holding, Hoffman-LaRoche, 3i and OC Oerlikon.

Current products include PC-6 Turbo Porter, PC-7 Mk II, PC-9M Turbo Trainer, PC-12 and PC-21. Headquarters and main plant at Stans, Switzerland. Wholly owned subsidiaries include Pilatus Business Aircraft Ltd in USA, Pilatus Australia Pty Ltd, in Australia and TSA Transairco and Altenrhein Aviation in Switzerland. There are also offices in UK, Malaysia and Abu Dhabi.

Deliveries in 2005 totalled 89 (of which 82 were PC-12s), for a turnover of CHF466 million, 57.5 per cent in US and 26 per cent in Europe.

PILATUS PC-6 TURBO PORTER

US Army designations: UV-20A Chiricahua and AU-23A Peacemaker

Royal Thai Air Force designation: B.JH 2

TYPE: Light utility transport.

PROGRAMME: First flight piston-engined prototype 4 May 1959 (see contemporary Jane's);

PC-6/A, A1, A2, B, B1, B2 and C2-H2 with various turboprops (see 1974-75 Jane's All the

World's Aircraft); superseded by PC-6/B2-H4, introduced mid-1985. Remains in production, but manufacture temporarily paused in 2000; c/n 939 departed to US in October 2000.

Manufacture reinstated; c/n 940 first flew 12 May 2003 and exported to France for CERP de Maubeuge as F-GRUB.

Full description of PC-6/B2-H4 in 2001-02 All the World's Aircraft and in current Jane's Aircraft Upgrades; following is shortened version.

CURRENT VERSIONS: **PC-6/B2-H4:** Gross weight for FAR Pt 23 passenger carrying increased by 600 kg (1,323 lb) over immediately previous B2-H2, giving up to 570 kg (1,257 lb) greater payload for CAR 3 operations; changes include turned-up wingtips, enlarged dorsal fin, uprated mainwheel shock-absorbers, new tailwheel assembly and slight airframe reinforcement; H4 changes can be retrofitted to B2-H2.

CUSTOMERS: Total of 534 built by late-2006, including 45 of piston-engined versions and 92 of early turboprop versions under licence manufacture by Fairchild in USA; some 290 remain in service in more than 50 countries. Six built 2003-04 and delivered to CERP de Maubeuge, France; Jereb Airservice, Germany; Gardenia, Italy; Yajasi Aviation, Indonesia (two); and CDP du Centre, Orleans, France. Two more in 2005 and at least five in 2006. See tables.



Pilatus PC-6/B2H4 Turbo Porter

1158822

PILATUS PC-6 ANNUAL PRODUCTION

		Swiss Prod	US Prod	Cum total
Year	Qty	Cum		
1959	4	4		4
1960	5	9		9
1961	22	31		31
1962	14	45		45
1963	14	59		59
1964	13	72		72
1965	23	95		95
1966	23	118	4	122
1967	35	153	22	179
1968	26	179	6	211
1969	27	206	8	246
1970	3	209	nil	249
1971	7	216	9	265
1972	5	221	15	285
1973	nil	221	5	290
1974	9	230	22	321
1975	15	245	1	337
1976	22	267		359
1977	17	284		376
1978	8	292		384
1979	5	297		389
1980	3	300		392
1981	5	305		397
1982	4	309		401
1983	9	318		410
1984	14	332		424
1985	2	334		426
1986	10	344		436
1987	5	349		441
1988	1	350		442
1989	7	357		449
1990	7	364		456
1991	4	368		460
1992	12	380		472
1993	12	392		484
1994	12	404		496
1995	1	405		497
1996	2	407		499
1997	3	410		502
1998	9	419		511
1999	6	425		517
2000	5	430		522
2003	1	431		523
2004	5	436		528
2005	6	442		534
Totals		442	92	534

DESIGN FEATURES: Rugged, light transport with STOL performance and easily accessible, versatile cabin. Braced, constant-chord, high wing with single strut each side; unswept fin with large dorsal fillet.

Wing section NACA 64-514 (constant) with span-increasing wingtips; dihedral 1°; incidence 2°.

LANDING GEAR: Non-retractable tailwheel type. Oleo shock-absorbers in all units. Steerable (±25°)/lockable tailwheel. Main tyres size 11.00–12 (8 ply), pressure 1.38 bar (20 lb/sq in), or 7.50–10 (8 ply). Tailwheel with size 5.00–4 (6 ply) tyre, pressure 3.24 bar (47 lb/sq in). Goodyear hydraulic disc brakes. Pilatus wheel/ski gear and (since July 1994) plain or amphibious floats optional.

POWER PLANT: One 507 kW (680 shp) Pratt & Whitney Canada PT6A-27 turboprop (flat rated at 410 kW; 550 shp at S/L), driving a Hartzell HC-B3TN-3D/T-10178 C or CH, or T10173 C or CH, three-blade constant-speed fully feathering reversible-pitch propeller with Beta mode control; four-blade propeller optional for operations in noise-sensitive areas. Standard fuel in integral wing tanks, usable capacity 644 litres (170 US gallons; 142 Imp gallons). Two underwing auxiliary tanks, each of 242.3 litres (64.0 US gallons; 53.3 Imp gallons), available optionally. For self-ferry, up to three 189 litre (50.0 US gallon; 41.6 Imp gallon) fuel tanks can be carried in main cabin.



Pilatus PC-6/B2-H4 Turbo Porter with optional port-side double door (Dennis Punnett)

1158777

ACCOMMODATION: Cabin has pilot's seat forward on port side, with one passenger seat alongside, and is normally fitted with six quickly removable seats, in pairs, to rear of these for additional passengers. Up to 11 persons, including pilot, can be carried in 2-3-3-3 high-density layout; or up to 10 parachutists; or two stretchers plus three attendants in ambulance configuration. Floor is level, flush with door sill, with seat rails. Forward-opening door beside each front seat. Large rearward-sliding door on each side of main cabin; fixed, external mounting step, starboard side. Optional double door, without central pillar, on port side. Hatch in floor 0.58 × 0.90 m (1 ft 10½ in × 2 ft 11½ in), openable from inside cabin, for aerial camera or supply dropping. Starboard side door in rear fuselage permits stowage of six passenger seats or accommodation of freight items up to 5.0 m (16 ft 5 in) in length. Walls lined with lightweight soundproofing and heat insulation material. Adjustable heating and ventilation systems. Dual controls optional.

EQUIPMENT: Generally to customer's requirements, but can include gear for parajumping role: stretchers for ambulance role; aerial photography and survey gear. Agricultural version no longer produced.

DIMENSIONS, EXTERNAL:

Wing span	15.87 m (52 ft 0¾ in)
Wing chord, constant	1.90 m (6 ft 3 in)
Wing aspect ratio	8.4
Length overall	10.90 m (35 ft 9 in)
Height overall (to top of rudder), tail down	3.20 m (10 ft 6 in)
Tailplane span	5.13 m (16 ft 10 in)
Wheel track	3.00 m (9 ft 10 in)
Wheelbase	7.87 m (25 ft 10 in)
Propeller diameter	2.67 m (8 ft 9 in)

DIMENSIONS, INTERNAL:

Cabin, from back of pilot's seat to rear wall:	
Length	2.30 m (7 ft 6½ in)
Max width	1.16 m (3 ft 9½ in)
Max height (at front)	1.28 m (4 ft 2½ in)
Height at rear wall	1.18 m (3 ft 10½ in)
Floor area	2.67 m² (28.6 sq ft)
Volume	3.3 m³ (107 cu ft)

AREAS:

Wings, gross	30.15 m² (324.5 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty, basic	1,250 to 1,400 kg (2,756 to 3,086 lb)
Max fuel weight: internal	508 kg (1,120 lb)
underwing	392 kg (864 lb)
Max payload: with reduced internal fuel	1,130 kg (2,491 lb)
with max internal fuel	1,200 kg (2,645 lb)
with max internal and underwing fuel	571 kg (1,259 lb)
Max T-O weight, Normal (CAR 3): wheels (standard)	2,800 kg (6,173 lb)
skis	2,600 kg (5,732 lb)
Max landing weight: wheels	2,660 kg (5,864 lb)
skis	2,600 kg (5,732 lb)
Max cabin floor loading	488 kg/m² (100 lb/sq ft)
Max wing loading (Normal):	
wheels	92.9 kg/m² (19.03 lb/sq ft)
skis	86.2 kg/m² (17.67 lb/sq ft)
Max power loading (Normal): wheels	6.83 kg/kW (11.22 lb/shp)
skis	6.34 kg/kW (10.42 lb/shp)

PERFORMANCE (Normal category):

Never-exceed speed (VNE)	151 kt (280 km/h; 174 mph) EAS
Max cruising speed at S/L	125 kt (232 km/h; 144 mph)
Econ cruising speed at 3,050 m (10,000 ft)	115 kt (213 km/h; 132 mph)
Stalling speed, power off: flaps up	58 kt (108 km/h; 67 mph) EAS
flaps down	52 kt (96 km/h; 60 mph) EAS
Max rate of climb at S/L	308 m (1,010 ft)/min
Max operating altitude	7,620 m (25,000 ft)
Service ceiling	6,250 m (20,500 ft)
T-O run at S/L: normal and STOL	197 m (650 ft)
T-O to 15 m (50 ft) at S/L: normal	475 m (1,560 ft)
STOL	440 m (1,445 ft)
Landing from 15 m (50 ft) at S/L at MLW, with propeller reversal	315 m (1,035 ft)
Landing run at S/L at MLW, with propeller reversal	127 m (420 ft)
Max range at 115 kt (213 km/h; 132 mph) at 3,050 m (10,000 ft), no reserves:	
with max payload	394 n miles (730 km; 453 miles)
with standard internal fuel	500 n miles (926 km; 576 miles)
with standard internal and underwing fuel	811 n miles (1,503 km; 933 miles)
g limits	+3.58/−1.43

PILATUS PC-7 MK II M TURBO TRAINER

SAAF name: Astra

TYPE: Basic turboprop trainer.

PROGRAMME: First production PC-7 baseline version flew 18 August 1978. Mk II launched 1992 and developed to bid for South African Air Force requirement; two prototypes (HB-HMR and -HMS), first of which made maiden flight 28 September 1992; SAAF contract announced June 1993; first production aircraft started January 1994 and made first flight August 1994. Since 1996, PC-7 Mk IIs and PC-9s were built from common fuselages, former being designated PC-7 Mk II M (for 'modular'). Final PC-7 Mk II M of first series was delivered to Malaysia in 2001.

Iran understood to be planning to build a modified PC-7 variant, known locally as IAMI (HESA) HT-80.

CUSTOMERS: South Africa (60); Brunei (four); Royal Malaysian Air Force (nine in 2001). Ten scheduled for production in 2006, but none identified by December 2006.

PILATUS PC-7 AND PC-7 MK II M PRODUCTION

Customer	Qty	First aircraft	First delivery
Military:			
Angola	26	R-401	1982
Austria	16	3H-FA	Oct 1983
Bolivia	24	450	Apr 1979
Bophuthatswana	3¹	T400	Dec 1989
Botswana	8	OD-1	Feb 1990
Brunei	4²	ATU-301	1997
Chile	10	N-210	May 1980
France	5	576	1991
Guatemala	12	218	Apr 1980



Pilatus PC-7 Mk II

115819

Customer	Qty	First aircraft	First delivery
Iran	35	8-9901	1983
Iraq	52	5000	Jul 1980
Malaysia	44	M33-01	Feb 1983
Mexico	88	501	Jul 1979
Myanmar	19	2300	1979
Netherlands	13	L-01	Jan 1989
South Africa	60 ²	2001	1994
Suriname	3 ³	111	Oct 1986
Switzerland	40	A-902	Aug 1979
UAE (Abu Dhabi)	31	901	Apr 1982
Uruguay	7	301	1992
Subtotal	500		
Civil:			
Pilatus	1 (P)	HB-HAO	
	2	HB-HOO	
	1	(stock)	
USA (various)	8	N701RB	
CIPRA	2 ⁴	F-GDME	
Martini	4	HB-HMA	
Total	520		

¹ To South African Air Force; returned to Pilatus and resold to private owners in 1998–99
² Mk II
³ No longer in service
⁴ Both to Chad Air Force

DESIGN FEATURES: Generally as for PC-9. Reduced-drag airframe based on that of PC-9M; higher-powered PT6A-25C engine with four-blade propeller; Martin-Baker Mk 11A ejection seats standard; optimised flying controls.

FLYING CONTROLS: Generally as for PC-9M, including trim aid device; stall strips and ventral fin added to improve stall characteristics and directional stability.

STRUCTURE: Generally as for PC-9M.

LANDING GEAR: Hydraulically actuated retractable tricycle type, with emergency manual extension. Mainwheels retract inward, nosewheel rearward. Oleo-pneumatic shock-absorber in each unit. Castoring nosewheel, with shimmy dampers. Tyres 6.50–8 (8 ply) all round, pressure 8.62 bar (125 lb/sq in) on mainwheels, 4.83 bar (70 lb/sq in) on nosewheel. Hydraulic disc brakes on mainwheels. Parking brake. Alternatively 6.50–8 main and 6.00–6 tailwheel tubeless tyres. Steering $\pm 61^\circ$ by differential braking; nosewheel steering ($\pm 12^\circ$) standard. Minimum ground turning radius 11.125 m (36 ft 6 in), based on nosewheel.

POWER PLANT: One 522 kW (700 shp) (flat-rated) Pratt & Whitney Canada PT6A-25C turboprop, driving a Hartzell HC-D4N-2A four-blade constant-speed fully feathering propeller. Two integral wing fuel tanks, each of 253 litres (66.8 US gallons; 55.7 Imp gallons) usable capacity, plus a 12 litre (3.2 US gallon; 2.6 Imp gallon) aerobatic tank in fuselage, giving total internal usable capacity of 518 litres (137 US gallons; 114 Imp gallons).

Provision for 155 litre (41.0 US gallon; 34.1 Imp gallon) long-range auxiliary tank or 246 litre (65.0 US gallon; 54.1 Imp gallon) ferry tank under each wing. Single overwing gravity fuelling point each side. Oil capacity 16 litres (4.2 US gallons; 3.5 Imp gallons). Capability for 30 seconds of inverted flight.

ACCOMMODATION: Instructor and pupil in tandem on stepped Martin-Baker Mk 11A ejection seats. One-piece canopy opens sideways to starboard. Cockpit unpressurised.

SYSTEMS: Vapour cycle environmental control system. Hydraulic system, pressure 207 bar (3,000 lb/sq in), for landing gear actuation, nosewheel steering and airbrake; system maximum flow rate 18.8 litres (4.97 US gallons; 4.14 Imp gallons)/min. Supplementary system as for PC-9M. Electrical system (28 V DC) powered by 200 A starter/generator and 24 V Ni/Cd battery. OBOGS standard.

AVIONICS: Standard IFR fit comprising:

Comms: Dual Rockwell Collins VHF-422D VHF Comm transceivers; single Honeywell KTR 909B UHF comm transceiver; TEAM audio/radio management system with CDU in each cockpit; L3 Communications FA2300 CVR; Honeywell MST 67A Mode S transponder; Martec Serpe-Iesm KANNAD 406AF ELT.

Flight: Dual Honeywell KNR 634A VHF digital navigation receivers; Chelton DME 441B DME or L3 Communications RT-1634(V) TACAN/DME receiver/transmitter; Rockwell Collins ADF-462 ADF; Honeywell KLN 900 GPS in front and rear cockpits; LITEF LCR-93 AHRS; Honeywell KDC 481T air data computer; Honeywell KRA 405B radar altimeter.

Instrumentation: Astronautics Corporation of America 152 × 203 mm (6 × 8 in) portrait format active matrix LCD flight display for PFD functions in front and rear cockpits; Meggitt Avionics 3 ATI independent secondary flight display with rear cockpit repeater; air data unit; magnetometer heading sensor; Astronautics Corporation of America EICAS with 127 × 102 mm (5 × 4 in) landscape format display in front and rear cockpits.

EQUIPMENT: As for PC-9M.

DIMENSIONS, EXTERNAL, INTERNAL AND AREAS: As for PC-9M

WEIGHTS AND LOADINGS (A: Aerobatic, U: Utility category with underwing stores):

Basic weight empty, equipped 1,670 kg (3,682 lb)

Max underwing stores load 1,040 kg (2,293 lb)

Max T-O weight: A 2,250 kg (4,960 lb)

U 2,850 kg (6,283 lb)

Max ramp weight: A 2,260 kg (4,982 lb)

U 2,860 kg (6,305 lb)

Max landing weight: A 2,250 kg (4,960 lb)

U 2,750 kg (6,062 lb)

Max zero-fuel weight: A 1,900 kg (4,189 lb)

Max wing loading: A 138.1 kg/m² (28.29 lb/sq ft)

U 175.0 kg/m² (35.83 lb/sq ft)

Max power loading: A 4.31 kg/kW (7.09 lb/shp)

U 5.46 kg/kW (8.98 lb/shp)

PERFORMANCE (A and U as above):

Max operating Mach number (MMO): A, U 0.60

Max operating speed (VMO): A, U 300 kt (555 km/h; 345 mph) EAS

Max cruising speed: A at S/L 242 kt (448 km/h; 278 mph)

A at 3,050 m (10,000 ft) 251 kt (465 km/h; 289 mph)

A at 7,620 m (25,000 ft) 225 kt (417 km/h; 259 mph)

Max manoeuvring speed: A 210 kt (389 km/h; 241 mph) EAS

U 200 kt (370 km/h; 230 mph) EAS

Max speed with flaps and/or landing gear down:

A, U 150 kt (277 km/h; 172 mph) EAS

Stalling speed:

flaps and landing gear up 75 kt (139 km/h; 87 mph) EAS

flaps and landing gear down 67 kt (124 km/h; 78 mph) EAS

Max rate of climb at S/L 866 m (2,840 ft)/min

T-O to 15 m (50 ft) 415 m (1,365 ft)

Landing run from 15 m (50 ft) 674 m (2,215 ft)

g limits: A +7/-3.5

U +4.5/-2.25

Max range 810 n miles (1,500 km; 932 miles)

PILATUS PC-9M ADVANCED TURBO TRAINER

Slovene Military Aviation name: Hudournik (Swift)

Royal Thai Air Force designation: BF. 19

TYPE: Basic turboprop trainer.

PROGRAMME: Design began May 1982; aerodynamic elements tested on PC-7 1982–83; first flights by two preproduction PC-9s: HB-HPA on 7 May 1984 and HB-HPB on 20 July 1984; aerobatic certification 19 September 1985. PC-9M introduced early 1997.

CURRENT VERSIONS: PC-9: Standard production version until 1997.

PC-9/A: Australian version of PC-9.

PC-9B: German target towing version of PC-9, operated for German Air Force by EIS Aircraft GmbH (previously Condor Flugdienst); increased fuel for a 3 hour 20 minute mission; two Meggitt RM-24 winches on inboard pylons with targets stowed aft of winch; TAS 06 acoustic scoring system.

PC-9 Mk II: Modified for US Air Force/Navy JPATS trainer programme; became Beech T-6A Texan II.

PC-9M: Upgraded version introduced 1997 and now the standard production model. Enlarged dorsal fin fairing (as on PC-7 Mk II M) improves longitudinal stability and reduces stick forces; modified wingroot fairings improve low-speed characteristics; 'exciter strips' on wing leading-edges improve stall characteristics; new engine/propeller control system separates flight idle and ground idle modes, reducing acceleration time and improving handling.

Detailed description applies to PC-9M.

Hudournik: (Swift) Dedicated weapons training version in service with Slovene Military Aviation, modified after delivery by Radom Aviation Systems of Israel. First example to

this standard (L9-61) made first flight early May 1999. Mission systems installation includes Litton INS-100G inertial navigation with GPS; HOTAS controls; Flight Visions HUD with up-front control and rear cockpit video repeater; a central flight data recorder; chaff/flare dispenser and control panel; Honeywell EFIS and displays; new weapon selection and armament control unit and displays; MIL-STD-1553B dual databus; and RS-422/ARINC 429 datalink. Maximum external stores load increased to 1,250 kg (2,756 lb).

CUSTOMERS: Total of 276 ordered and built by 2006. Saudi aircraft prepared for delivery by British Aerospace; first pair from second batch (Nos. 31 and 32) handed over in UK on 4 December 1995. Order for eight for Irish Air Corps, with weapons hardpoint, announced 16 January 2003, for delivery and operational capability by mid-2004. First aircraft (260) flew 6 February 2004. Bulgarian Air Force ordered six, for delivery during 2004; first aircraft (663) flew on 20 September 2004 and last delivered December 2004. One PC-9 and two PC-9M scheduled for delivery to Chad and Mexico respectively during 2006.

PILATUS PC-9 PRODUCTION (EXCLUDING BEECH T-6)

Customer	Version	Qty	First aircraft	First delivery
Military				
Angola	PC-9	4	(c/n 115)	1987
Australia	PC-9/A	67 ¹	A23-001	Oct 1987
Bulgaria	PC-9M	6	663	2004
Chad	PC-9	1	TT-QAG	2006
Croatia	PC-9M	17 ⁴	054	1997
Cyprus	PC-9	2	901	1989
Iraq	PC-9	20	5801	1987
Ireland	PC-9M	8	260	2004
Mexico	PC-9M	2 ⁷	2601	Sep 2006
Myanmar	PC-9	10	3601	Apr 1986
Oman	PC-9M	12	426	1999
Saudi Arabia	PC-9	50	2201	Jan 1987
Slovenia	PC-9M	9 ⁵	L9-61	Nov 1998
Switzerland	PC-9	14 ²	C-401	1987
Thailand	PC-9	36	1/34	1991
US Army	PC-9	3 ³	91-071	1991
Subtotal		261		
Civil				
Pilatus	PC-9	2	HB-HPA	
	PC-9 Mk II	1	HB-HPC	
	PC-9M	1	HB-HPJ	
Condor	PC-9B	10 ⁶	D-FAMT	Sep 1990
BAE	PC-9	1	ZG969	Jul 1989
Total		276		

¹ First 17 (after two from Pilatus) assembled by Hawker de Havilland from Swiss kits; final 48 locally built
² First two for evaluation; returned to Pilatus
³ Transferred to Slovenia in 1995; now L9-51 et seq
⁴ Plus three second-hand (051 et seq)
⁵ Modified to Hudournik standard in Israel after delivery
⁶ Plus ex-demonstrator, August 2000
⁷ Believed total 18 on order

DESIGN FEATURES: Student turboprop trainer; stepped cockpits; aerobatic; performance and handling ease typical's transition to jets. Meets FAR Pt 23 (Aerobatic 52) and special Swiss federal civil conditions for both Aerobatic and Utility categories; complies with selected parts of US military training specifications.

Conventional, low-wing monoplane; parallel chord wing centre-section; tapered outer panels; tailplane LERX.

Wing section PIL15M825 at root, IL12M850 at tip; quarter-chord sweepback 1°; dihedral 7° from centre-section; incidence 1° at root; twist -2°.

FLYING CONTROLS: Conventional and manual. Cable-operated elevator and rudder; ailerons operated by pushrods; mass-balanced, electrically actuated trim tab in each aileron and starboard half of elevator; electrically actuated trim/anti-balance tab in rudder controlled from rocker switch on power control lever. Trim aid device (TAD) automatically adjusts rudder trim tab setting in response to changes in engine torque or aircraft airspeed. This counteracts aircraft yaw induced by variations in effect of propeller slipstream, depending upon airspeed and engine power setting. TAD can be selected on or off by switch on trim control panel on left-hand side panel of front cockpit. Electrically operated split flaps, deflections 0°, 23° (take-off) and 50° (landing), hydraulically operated 'perforated' airbrake under centre-fuselage.

STRUCTURE: All-metal with some GFRP wing/fuselage fairings; one-piece wing with auxiliary spar, ribs and stringer-reinforced skin.

LANDING GEAR: Retractable tricycle type, with hydraulic actuation. Mainwheels retract inward to lie semi-recessed in wing centre-section covered by bulged doors; nosewheel retracts rearward; all units enclosed when retracted. Oleo-pneumatic shock-absorber in each leg. Hydraulically actuated nosewheel steering. Goodrich wheels and tubeless tyres, with Goodrich multipiston hydraulic disc brakes on mainwheels. Main tyres 20x4.4 (8 ply), nose tyre 16x4.4 (8 ply). Low-pressure tyres optional. Parking brake.

POWER PLANT: One 857 kW (1,150 shp) Pratt & Whitney Canada PT6A-62 turboprop, flat rated at 708 kW (950 shp), driving a Hartzell HC-D4N-ZA/09512A four-blade constant-speed full feathering propeller. Single-lever engine control. Propeller is controlled by a constant-speed unit (CSU) and a variable-speed propeller governor system (VPGS). VPGS provides a linear engine power response resulting in balanced engine loads and reduced yaw moments. VPGS automatically varies the propeller speed between 1,750 and 2,000 rpm in response to engine torque. CSU adjusts the blade pitch to achieve a propeller speed as determined by the VPGS.

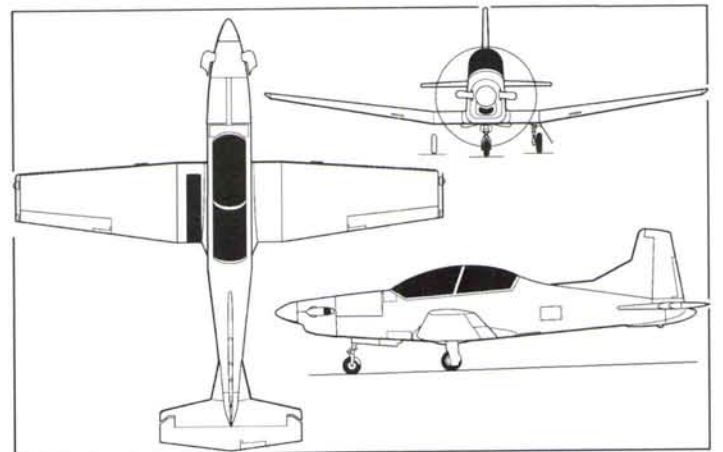
Fuel in two integral tanks in wing leading-edges, total capacity 540 litres (143 US gallons; 119 Imp gallons), of which 518 litres (137 US gallons; 114 Imp gallons) usable. Overwing refuelling point on each side. Fuel system includes 12 litre (3.2 US gallon; 2.6 Imp gallon) aerobatics tank in fuselage, forward of front cockpit, which permits up to 60 seconds of inverted flight. Provision for two 154 or 248 litre (40.7 or 65.5 US gallon; 33.9 or 54.5 Imp gallon) drop tanks on centre underwing attachment points. Total oil capacity 16 litres (4.2 US gallons; 3.5 Imp gallons).

ACCOMMODATION: Two Martin-Baker Mk 11A adjustable ejection seats, each with integrated personal survival pack and fighter-standard pilot equipment. Stepped tandem arrangement with rear seat elevated 15 cm (5.9 in). Seats operable, through canopy, at zero height and speeds down to 60 kt (112 km/h; 70 mph) EAS. Anti-g system. One-piece acrylic Perspex windscreen; one-piece framed canopy, incorporating roll-over bar, opens sideways to starboard. Dual controls standard. Cockpit heating, cooling, ventilation and canopy



Irish Air Corps Pilatus PC-9 (Paul Jackson)

1158186



Pilatus PC-9M turboprop trainer

1158187

demisting standard. Space for 25 kg (55 lb) of baggage aft of seats, with external access. **SYSTEMS:** Vapour cycle air conditioning system and engine bleed air for cockpit heating/ventilation and canopy demisting. Fairey Systems hydraulic system, pressure 207 bar (3,000 lb/sq in), for actuation of landing gear, mainwheel doors, nosewheel steering and airbrake; system maximum flow rate 18.8 litres (4.97 US gallons; 4.14 Imp gallons)/min. Bootstrap oil/oil reservoir, pressurised at 3.45 to 207 bar (50 to 3,000 lb/sq in). A supplementary high-pressure, one-shot nitrogen storage bottle provides power to lower the landing gear in an emergency. This bypasses the main hydraulic systems by feeding directly into shuttle valves in the down side of the main door and landing gear actuators.

Primary electrical system (28 V DC operational, 24 V nominal) powered by 30 V 300 A starter/generator and 24 V 40 Ah Ni/Cd battery. Ground power receptacle. Electric anti-icing of pitot tubes, static ports and AoA transmitter standard; electric de-icing of propeller blades. Diluter demand oxygen system, capacity 1,350 litres (47.6 cu ft) selected and controlled individually from panel in each cockpit. OBOGS standard.

AVIONICS: Standard avionics, described below, can be augmented or replaced by alternative equipment to customers' requirements.

Comms: Dual Rockwell Collins VHF-422D VHF transceivers; single Honeywell KTR 909B UHF transceiver; TEAM audio/radio management system in each cockpit; L3 Communications FA2300 CVR and FDR with crash-survivable memory and underwater acoustic beacon, recording up to two hours of standard quality and a minimum of 30 minutes of high quality cockpit audio and a minimum of 25 hours of flight data, latter retrievable for fatigue life management and engine condition monitoring; Honeywell MST 67 A Mode S transponder; Martec Serpe-lesm KANNAD 406AF ELT.

Flight: Dual Honeywell KNR 634A VHF digital navigation receivers; Chelton DME 441B DME or L3 Communications RT-1634(V) TACAN/DME receiver/transmitter; Rockwell Collins ADF-462 ADF; Honeywell KLN 900 GPS in front and rear cockpits; LITEF LCR-93 AHRS; Honeywell KDC 481T air data computer; Honeywell KRA 405B radar altimeter.

Instrumentation: Astronautics Corporation of America 152 x 203 mm (6 x 8 in) portrait format active matrix LCD flight display for PFD functions in front and rear cockpits; Meggit Avionics 3 ATI independent secondary flight display with rear cockpit repeater; air data unit; magnetometer heading sensor; Astronautics Corporation of America EICAS with 127 x 102 mm (5 x 4 in) landscape format display in front and rear cockpits; IFR advanced avionics configuration adds CMC Electronics FV4000 HUD computer; Sparrowhawk HUD (with integrated up-front control panel and front-mounted camera); front cockpit video display unit or HUD repeater; TEAC Aerospace Technologies MDR 80C rear cockpit mission data recorder, and substitutes Honeywell HG2100AB04 micro inertial reference unit and HG2021 GD02 global navigation satellite sensor unit for LITEF LCR-93 AHRS.

EQUIPMENT: Three hardpoints under each wing; inboard and centre stations each stressed for 250 kg (551 lb), outboard stations for 110 kg (242.5 lb) each. Retractable 250 W landing/taxying light in each main landing gear leg bay. Optional equipment can include smoke generators for aerial displays, target towing kit, electronic jammer for EW training, and blind-flying hood.

ARMAMENT: FN Herstal package for Hudournik/Swift comprises HMP-250 12.7 mm gun pods; LAU-7A seven-round unguided rocket launchers; Alkan Type 65 adaptor and dispensers for IBDU-33 practice bombs; and a laser range-finder pod.

DIMENSIONS, EXTERNAL:

Wing span	10.18 m (33 ft 5 in)
Wing chord: mean aerodynamic	1.65 m (5 ft 5 in)
mean geometric	1.61 m (5 ft 3½ in)
Wing aspect ratio	6.3
Length overall	10.13 m (33 ft 3 in)
Fuselage max width	0.97 m (3 ft 2¼ in)
Height overall	3.26 m (10 ft 8⅝ in)
Tailplane span	3.665 m (12 ft 0¼ in)
Wheel track	2.54 m (8 ft 4 in)
Wheelbase	2.31 m (7 ft 7 in)
Propeller diameter	2.44 m (8 ft 0 in)
Propeller ground clearance	0.18 m (7 in)

DIMENSIONS, INTERNAL:

Baggage compartment volume	0.14 m ³ (4.9 cu ft)
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AREAS:

Wings, gross	16.29 m ² (175.3 sq ft)
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Ailerons (total)	1.57 m ² (16.90 sq ft)
Trailing-edge flaps (total)	1.77 m ² (19.05 sq ft)
Airbrake	0.30 m ² (3.23 sq ft)
Fin	0.86 m ² (9.26 sq ft)
Rudder, incl tab	0.90 m ² (9.69 sq ft)
Tailplane	1.80 m ² (19.38 sq ft)
Elevator, incl tab	1.60 m ² (17.22 sq ft)

WEIGHTS AND LOADINGS (A: Aerobatic, U: Utility category with underwing stores):

Basic weight empty, equipped	1,725 kg (3,803 lb)
Max underwing stores load	1,040 kg (2,293 lb)
Max T-O weight: A	2,350 kg (5,180 lb)
U	3,200 kg (7,054 lb)
Max ramp weight: A	2,360 kg (5,203 lb)
U	3,210 kg (7,076 lb)
Max landing weight: A	2,350 kg (5,180 lb)
U	3,100 kg (6,834 lb)
Max zero-fuel weight: A	2,000 kg (4,409 lb)
Max wing loading: A	144.3 kg/m ² (29.55 lb/sq ft)
U	196.4 kg/m ² (40.23 lb/sq ft)
Max power loading: A	3.32 kg/kW (5.45 lb/shp)
U	4.52 kg/kW (7.42 lb/shp)

PERFORMANCE (A and U as above, propeller speed 2,000 rpm):

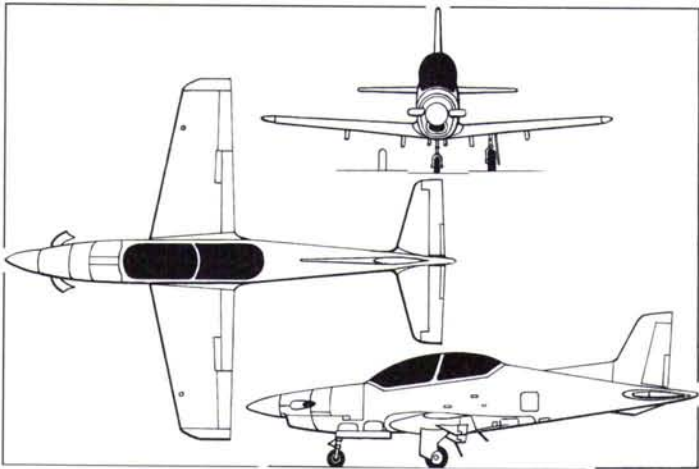
Max operating Mach number (MMO): A, U	0.65
Max operating speed (VMO): A, U	320 kt; (593 km/h; 368 mph) EAS
Max cruising speed: A at S/L	271 kt (501 km/h; 311 mph)
A at 3,050 m (10,000 ft)	298 kt (552 km/h; 343 mph)
A at 7,620 m (25,000 ft)	300 kt (556 km/h; 345 mph)
Max manoeuvring speed: A	205 kt (380 km/h; 236 mph) EAS
U	200 kt (370 km/h; 230 mph) EAS
Max speed with flaps and/or landing gear down:	
A, U	150 kt (278 km/h; 172 mph) EAS
Stalling speed, engine idling: flaps and gear up: A	76 kt (141 km/h; 87 mph) EAS
U	90 kt (167 km/h; 104 mph) EAS
flaps and gear down: A	69 kt (128 km/h; 80 mph) EAS
U	67 kt (124 km/h; 77 mph) EAS
Max rate of climb at S/L: A	1,183 m (3,880 ft)/min
Time to 4,575 m (15,000 ft): A	4 min 5 s
Max operating altitude: A, U	7,620 m (25,000 ft)
Service ceiling: A, U	11,580 m (38,000 ft)
T-O run at S/L: A	243 m (795 ft)
T-O to 15 m (50 ft) at S/L: A	396 m (1,300 ft)
Landing from 15 m (50 ft) at S/L at MLW:	
A	687 m (2,255 ft)
Landing run at S/L at MLW:	
A (normal braking action)	351 m (1,150 ft)
Max range at 210 kt (389 km/h; 242 mph) at 7,620 m (25,000 ft), 5% and 20 min fuel reserves:	
A	830 n miles (1,537 km; 955 miles)
Max range, no reserves	1,065 n miles (1,970 km; 1,225 miles)
Max endurance at 110 kt (204 km/h; 127 mph) IAS, conditions as above: A	4 h 30 min
g limits: A	+7/-3.5
U	+4.5/-2.25

PILATUS PC-21

TYPE: Basic turboprop trainer.

PROGRAMME: Project launched November 1998; development began January 1999; provisional designation chosen to indicate 21st Century technology, but was retained for commercial use; first brief details revealed late 1999; modified PC-7 Mk II development aircraft (HB-HMS) flying by October 2000 with a sweptback fin, spoilers, power management system and five-blade propeller; later received PC-21 avionics and mission management system.

Prototype (HB-HZA) rolled out 1 May 2002; first flight 1 July 2002; public debut at Royal International Air Tattoo, Fairford, UK, 20–21 July 2002, at which time the aircraft had flown some 14 hours, including ferry time; more than 500 hours flown by October 2004; appeared at Farnborough Air Show from 22 July 2002. Second development aircraft (HB-HZB) flew 7 June 2004 and made first public appearance at RIAT, Fairford, UK, July 2004. Civil VFR certification achieved 23 December 2004, to be followed by IFR in mid-2006. Second development aircraft was destroyed in a crash at Buochs, Switzerland, on 13 January 2005. First series production aircraft (HB-HZC) flew 29 August 2005 and served as autopilot certification aircraft alongside HB-HZA, which assumed HB-HZB's role as systems development and demonstration airframe. Second production HB-HZD, completed early 2006.



Pilatus PC-21 advanced turboprop trainer (James Goulding)

1158233

On 3 November 2006, Lockheed Martin Simulation awarded 20-year contract to supply pilot training services to Republic of Singapore Air Force at RAAFB Pearce, Western Australia, with equipment including 19 PC-21s.

CUSTOMERS: Singapore 19 (via Lockheed Martin contract). Estimated market for 1,000 aircraft in class over 20-year period, of which Pilatus hopes to capture 50 per cent: Australia, Switzerland (expected to acquire six early production airframes), UAE and UK seen as primary marketing targets for launch orders. Marketing strategy includes complete Pilatus-operated training packages, employing PC-21s.

COSTS: Company-funded development cost estimated at CHF200 million; unit cost CHF10 million (2004).

DESIGN FEATURES: Optimised for advanced flying (pilot) and weapons training (pilot and WSO), but at turboprop cost; high wing loading. Avionics able to simulate aiming and release of multiple weapons (in excess of aircraft's actual carrying capability) without resort to training rounds, although addition of underwing stores pylons is possible. Jet-like response assisted by digital power management system which schedules full power at 200 kt (370 km/h; 230 mph) and above. Propeller and spinner angled 4° down and 4° starboard to offset full torque, while wing and fin slightly offset for similar reason; optional automatic yaw compensation. Design aims included superior aerodynamic performance; integrated and cost-effective training system; and (30-year) life-cycle support cost not exceeding current turboprop trainers.

Wing leading-edge sweepback 12° 42'; tailplane sweepback approximately 16°; dihedral from roots.

FLYING CONTROLS: Conventional, Manually actuated rudder and elevator; hydraulic ailerons. Door-type spoiler in each wing upper surface, ahead of outboard one-third of flaps, to enhance roll. Flight-adjustable trim tabs in rudder, each aileron and each half of tailplane. Flaps hydraulically actuated.

STRUCTURE: New design; three-spar wing; wing leading-edges of impact-absorbent material for birdstrike resistance.

LANDING GEAR: Retractable tricycle type, with single wheel on each unit. Retraction inwards (mains) and rearward (nose). Mainwheel tyres size 20x14.4R12, pressure 16.6 bar (240 lb/sq in); nosewheel tyre size 10x4.4R8, pressure 11.0 bar (160 lb/sq in).

POWER PLANT: One 1,193 kW (1,600 shp) Pratt & Whitney Canada PT6A-68B turboprop, driving a Hartzell E8991KX five-blade 'Scimitar' graphite/titanium propeller.

ACCOMMODATION: Two in tandem on Martin-Baker Mk 16L zero-zero ejection seats in pressurised cockpit. Two-section acrylic canopy manufactured by Mecaplex of Switzerland, with thickened front for birdstrike resistance without resort to separate windscreen. Rear seat height increased in comparison with PC-9; front occupant has -11° forward view; rear occupant -4° 40'.

SYSTEMS: OBOGS, ECS and VCCS standard.

AVIONICS: Instrumentation: 'Glass cockpit' featuring three 152 x 203 mm (6 x 8 in) AMLCD PFDs and two 76 mm (3 in) Meggitt AMLCD secondary flight displays in each cockpit; Flight Visions SparrowHawk HUD with FVD-4000 HUD symbol generator standard in front cockpit; HUD repeater in rear cockpit; displays are NVG-compatible. Digital recording of all displays for post-flight debriefing.

Mission: Inputs to mission system are made via multifunction displays MFD soft keys, up-front control panel (UFCP) in front cockpit, and HOTAS.

Embedded simulation and mission planning/debriefing. Integrated ground-based training environment.



Third (first production) Pilatus PC-21 (Katsuhiko Tokunaga, Pilatus)

1158825

ARMAMENT: Provision for external stores on one centreline and four underwing hardpoints.	
DIMENSIONS, EXTERNAL:	
Wing span	9.12 m (29 ft 11 in)
Length overall	11.25 m (36 ft 11 in)
Height overall	3.76 m (12 ft 4 in)
Fuselage: Max depth	2.015 m (6 ft 7 3/4 in)
Max width	1.00 m (3 ft 3 3/4 in)
Tailplane span	4.00 m (13 ft 1 1/2 in)
Wheel track	2.72 m (8 ft 11 in)
Wheelbase	2.49 m (8 ft 2 in)
Propeller diameter	2.39 m (7 ft 10 in)
AREAS:	
Wing, gross	15.22 m ² (163.8 sq ft)
WEIGHT AND LOADINGS:	
Weight empty	2,280 kg (5,027 lb)
T-O weight: Aerobatic (clean)	3,100 kg (6,834 lb)
with underwing tanks	3,600 kg (7,936 lb)
max	4,250 kg (9,370 lb)
Max external load	1,150 kg (2,535 lb)
Max wing loading	279.2 kg/m ² (57.19 lb/sq ft)
Max power loading	3.56 kg/kW (5.86 lb/shp)
PERFORMANCE (estimated):	
Max operating speed	370 kt; (685 km/h; 426 mph)
Design diving speed	420 kt; (778 km/h; 483 mph)
Max level speed: at S/L	323 kt (598 km/h; 372 mph)
at FL100	337 kt (624 km/h; 388 mph)
Stalling speed: flaps and gear up	92 kt (171 km/h; 106 mph)
flaps and gear down	81 kt (150 km/h; 94 mph)
T-O run to 15 m (50 ft)	725 m (2,380 ft)
Landing from 15 m (50 ft)	900 m (2,955 ft)
Max rate of climb at S/L	1,295 m (4,248 ft)/min
Time to climb to FL100	2 min 35 s
Max certified altitude	7,620 m (25,000 ft)
Service ceiling	11,582 m (38,000 ft)
g limits: Aerobatic	+8/-5
Utility	+4/-2.5
sustained at S/L	+3.7
Max range	720 n miles (1,333 km; 828 miles)

PILATUS PC-12

US Air Force designation: U-28A

TYPE: Light utility turboprop.

PROGRAMME: Announced at NBAA Convention October 1989; first flight P.01 (HB-FOA) 31 May 1991; first flight of P.02 second prototype (HB-FOB) 28 May 1993; Swiss certification to FAR Pt 23 Amendment 42 (covering FAR Pt 135 commercial and Pt 91 general operations) received 30 March 1994, FAA type approval 15 July 1994, and FAR Pt 25 certification for flight into known icing conditions in 1995. Deliveries (N312BC to Carlson Leasing Corporation in USA) began September 1994.

Higher gross weight option (4.5 tonnes, hence **PC-12/45**) introduced in 1996 and gained FAA certification on 31 July 1996; became production standard by 1997. FAA FAR Pt 135 approval for commercial single-engine IFR operations announced in third quarter 1997; production increased from three to four per month in August 1997. First airline scheduled service operator (1997) was Kelner Airways of Canada. Total of 76 ordered and 51 delivered in 1998 (including 100th in April); 29 ordered in first half of 1999; 200th sale announced at NBAA Convention. Worldwide fleet hours passed 1 million in February 2005. Now certified in 26 countries, 1,500th Pilatus single-engine turboprop, manufactured in mid-2001, was PC 12 N377PC. Delivery of 500th PC-12 effected in December 2004, followed by 600th in April 2006.

CMC Electronics enhanced vision system available from early 2006.

Improved version, **PC-12/47**, announced on eve of at NBAA Convention, Orlando, Florida, 8 November 2005; available from January 2006. EASA certification granted 23 June 2006. Max T-O weight increased to 4,740 kg (10,450 lb), to permit either 240 kg (529 lb) extra payload or 350 n mile (648 km; 402 mile) range extension; new design, flatter winglet based on that of PC-21 which enhanced aileron control and provides improved crosswind handling; Flettner tabs on ailerons; control harmony improved, resulting in 60 per cent reduction in roll control forces; new crew seats by Ipeco; colour balanced LED cabin lighting and LED navigation lighting.

Next Generation PC-12 announced at NBAA Convention, Orlando, October 2006. PT6A-67P engine, with 15 per cent more thermodynamic power, and Honeywell Primus Apex four-screen (two PFD, two MFD) cockpit, with cockpit styling by BMW Designworks USA; certification expected late 2007.

CURRENT VERSIONS: **Standard:** Nine-passenger commuter or passenger/cargo combi.

Detailed description applies to standard PC-12/47 except where indicated.

Executive: Six to eight passenger seats.

PC-12M and Spectre: Multi-mission versions; described separately.

U-28A: Announced October 2005 as designation of six (civil-registered as N419WA, N424PB, N447PC, N482WA, N666GT and N922RG) PC-12s operated by 319th Special Operations Squadron of 16th SOW, US Air Force, at Hurlburt Field, Florida.



Next Generation Pilatus PC-12 Honeywell Primus Apex cockpit

1158824

CUSTOMERS: Completion of 300th production aircraft effected in 2001; 400th in (N500ZP) in August 2003; 500th (N600PE) to the Barclay Group (Integrated Aviation Services) of Scottsdale, Arizona, in December 2004, and 600th (N600KP) on 28 April 2006 to Aviation Sales Inc for a California-based customer. Deliveries in 2000 and 2001 totalled 70 each, 45 in 2002, 55 in 2003, 70 in 2004 and 80 in 2005. Production rate increased to 90 per year in 2006. Some 59 per cent of first 400 aircraft are registered in USA; further 14 per cent in Canada (including nine with Royal Canadian Mounted Police). Sales total 18 per cent in air ambulance configuration; 8 per cent airline use; and 74 private/corporate operators. US Drug Enforcement Agency (DEA) received two in transport configuration in December 1999 and October 2000, and placed further orders for ICE surveillance version. Other customers include those in Argentina (Border Guard), Australia (Royal Flying Doctor Service with 17 aircraft, including three delivered in early 2002), Austria, Bangladesh, Belize, Bermuda, Brazil, Bulgaria, Canada, Denmark, France, Germany, Greece, India, Japan, Kenya, Mexico, Netherlands, Norway, Poland, Russia, South Africa (Red Cross), Switzerland, Thailand, Uruguay, USA and Zimbabwe.

First single-engine turboprop fractional ownership scheme involved PC-12s of Alpha Flying's PlaneSense programme. Similar scheme, based on hourly use, introduced 2001 by Lions Air TimeJet of Zurich, Switzerland, since when several other PC-12 fractional ownership schemes have been launched.

COSTS: Basic price USD2,875 million; typically equipped USD 3.4 million (2006). Direct operating cost USD440 per hour (2006).

DESIGN FEATURES: Low-wing monoplane with tapered wing and T tail; latter's mounting reduces trim changes with power; CG range 13 to 46 per cent of MAC. Modifications following early flight trials include introduction of winglets, increased wing span, paired elevators instead of single surface, sweptback tailplane/elevator tips, addition of tailplane/fin bullet fairing, and enlarged dorsal fin and ventral strakes.

Wing sections (modified NASA GA(W)1 series), LS(1)-0417 MOD at root and LS(1) 0313 at tip.

FLYING CONTROLS: Conventional and manual. Actuation by pushrods and cables; servo tab in each aileron; electrically actuated Flettner tab in rudder; short-span mass-balanced ailerons; electrically actuated Fowler flaps cover 67 per cent of wing trailing-edge; electrically actuated (dual redundant) variable incidence tailplane.

STRUCTURE: Aluminium alloy primary skin and structure; composites for ventral strakes and dorsal fin (Kevlar/honeycomb sandwich), wingtips (glass fibre), fairings, engine cowling (glass fibre/honeycomb sandwich) and interior trim; titanium firewall; two-spar wing with integral fuel tankage; airframe proved for 20,000 hour life; complete internal and external corrosion protection.

All parts fabricated in Switzerland, but wings and fuselage assembled by OGMA in Portugal before return to Swiss production line. North American interiors installed in USA finishing centre; others outfitted at Stans.

LANDING GEAR: Pilatus hydraulically retractable tricycle type, with single wheel on each unit; nosewheel mechanically steerable $\pm 12^\circ$ by rudder pedals, or $\pm 60^\circ$ with differential braking. Emergency extension system; toe operated brakes; parking brake. Suitable for operation from grass strips, Goodrich wheels and low-pressure tyres on all units; size 22x8.50-10 on main gear, 17.5x6.25-6 on nose unit; tyre pressure 4.14 bar (60 lb/sq in) all round. Propeller ground clearance maintained with nose leg compressed and nosewheel tyre flat.



South African-registered Pilatus PC-12 with ethnic paint scheme

1158823

Trailing-link main gear retracts inward into wings, nose gear rearward under flight deck. Ground turning radius about wingtip 9.8 m (32 ft 2 in), about main gear 4.53 m (14 ft 10 in). POWER PLANT: One 1,197 kW (1,605 shp) Pratt & Whitney Canada PT6A-67B turboprop, flat rated to 895 kW (1,200 shp) for T-O and 746 kW (1,000 shp) for climb and cruise. Hartzell HC-E4A-3D/E10477K constant-speed, fully feathering reversible-pitch four-blade aluminium propeller, turning at 1,700 rpm. Two integral fuel tanks in wings, total capacity 1,540 litres (407 US gallons; 339 Imp gallons), of which 1,522 litres (402 US gallons; 335 Imp gallons) are usable. Gravity fuelling point in top of each wing. Oil capacity 11 litres (2.9 US gallons; 2.4 Imp gallons).

ACCOMMODATION: Two-seat flight deck: approved for single pilot, with dual controls; second flight instrument panel optional. Limit of nine passengers under FAR Pt 23, or executive layout for six to eight, both with lavatory. Two or three stretcher patients, plus life support systems and medical attendants, in ambulance configuration. Downward-opening airstair crew/passenger door at front, upward-opening cargo door at rear, both on port side; Type III emergency exit above wing on starboard side.

SYSTEMS: Normalair Garrett engine bleed air ECS, maximum pressure differential 0.4 bar (5.8 lb/sq in), maintaining a 2,440 m (8,000 ft) cabin altitude at 7,620 m (25,000 ft) and a 3,050 m (10,000 ft) cabin altitude at 9,150 m (30,000 ft). Vickers Systems (Germany) hydraulic system, pressure 207 bar (3,000 lb/sq in), for landing gear actuation. Electrical power system (28 V DC) supplied by 300 A engine-driven starter/generator, 130 A back-up alternator and 24 V 40 Ah Ni/Cd or 24 V 42 Ah lead-acid battery. Second battery optional. Goodrich pneumatic boot de-icing of wing and tailplane leading-edges; Goodrich electric anti-icing of windscreen, propeller blades, pitot probes and stall warning sensor; exhaust air anti-icing of engine air intake. Oxygen system for crew and passengers.

AVIONICS: *Comms:* Bendix/King dual KX 165A VHF nav/com transceivers, KMA 24H audio control/voice activated intercom system, KT 70 Mode S transponder, KR 21 marker beacon receiver, and SEPREF-IESM kannad 121 ELT, all standard; Bendix/King KHF 950 HF radio optional.

Radar: Honeywell RDR 2000 weather radar standard, mounted in wing pod.

Flight: Honeywell KFC 325 autopilot system, KN 63 DME, KR 87 ADF, KN1 582 RMI, KRA 405 radar altimeter, KEA 130A encoding altimeter, Bendix/King KLN 90B GPS and Litef LCR-92 AHRS standard; second LCR-92, WX 1000E Stormscope, TCAS 66A, Mk VI GPWS, KMD 850 MFD, IHAS 8000 traffic and terrain awareness system, Max-Viz EVS-1000 and CMC Electronics enhanced vision systems, and co-pilot's EFIS, all optional.

Instrumentation: Bendix/King EHI 40/50 EFIS with 102 mm (4 in) display standard; 127 mm (5 in) EFIS on pilot and co-pilot panels, optional. Central Advisory and Warning System (CAWS) standard.

DIMENSIONS, EXTERNAL:

Wing span	16.28 m (53 ft 5 in)
Wing aspect ratio	10.3
Length overall	14.40 m (47 ft 3 in)
Height overall	4.27 m (14 ft 0 in)
Elevator span	5.21 m (17 ft 1 in)
Wheel track	4.52 m (14 ft 10 in)
Wheelbase	3.53 m (11 ft 7 in)
Propeller diameter	2.67 m (8 ft 9 in)
Propeller ground clearance	0.32 m (1 ft 0 1/2 in)
Passenger door: Height	0.61 m (2 ft 0 in)
Width	0.635 m (2 ft 1 in)
Cargo door: Height	1.32 m (4 ft 4 in)
Width	1.35 m (4 ft 5 in)
Emergency exit: Height	0.66 m (2 ft 2 in)
Width	0.46 m (1 ft 6 in)

DIMENSIONS, INTERNAL:

Cabin: Length, excl flight deck	5.16 m (16 ft 11 in)
Max width	1.52 m (5 ft 0 in)
Width at floor	1.295 m (4 ft 3 in)
Max height	1.47 m (4 ft 10 in)
Volume	9.34 m ³ (330 cu ft)
Baggage compartment volume	1.13 m ³ (40 cu ft)

AREAS:

Wings, gross	25.81 m ² (277.8 sq ft)
Horizontal tail surfaces	5.49 m ² (59.09 sq ft)
Vertical tail surfaces	3.83 m ² (41.23 sq ft)
Flaps (total)	5.56 m ² (59.85 sq ft)
Ailerons (total)	1.24 m ² (13.35 sq ft)
Elevators (total)	1.64 m ² (17.65 sq ft)
Rudder	1.14 m ² (12.27 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, commuter/airliner	2,661 kg (5,866 lb)
Basic operating weight: single pilot	2,751 kg (6,065 lb)
executive	2,978 kg (6,565 lb)
Max usable fuel	1,226 kg (2,703 lb)

Max payload, commuter/airliner	1,349 kg (2,974 lb)
executive	1,123 kg (2,476 lb)
Payload with max fuel: executive	554 kg (1,221 lb)
Max T-O and landing weight	4,740 kg (10,450 lb)
Max zero-fuel weight	4,100 kg (9,039 lb)
Max wing loading	183.7 kg/m ² (37.61 lb/sq ft)
Max power loading	5.30 kg/kW (8.71 lb/shp)

PERFORMANCE:

Max operating Mach number (MMO)	0.48
Max operating speed (VMO)	240 kt (444 km/h; 276 mph) CAS
Max cruising speed at 7,620 m (25,000 ft)	270 kt (500 km/h; 311 mph)
Stalling speed:	
flaps and gear up	92 kt (171 km/h; 106 mph) IAS
flaps and gear down	66 kt (122 km/h; 76 mph) IAS
Max rate of climb at S/L	480 m (1,575 ft)/min
Max certified altitude	9,150 m (30,000 ft)
T-O run	503 m (1,650 ft)
T-O to 15 m (50 ft)	808 m (2,650 ft)
Landing from 15 m (50 ft) at MLW	558 m (1,830 ft)
Landing run at MLW	288 m (945 ft)
Max range at 7,925 m (26,000 ft), NBAA IFR reserves:	
commuter/airliner	1,782 n miles (3,300 km; 2,050 miles)
executive	1,739 n miles (3,221 km; 2,001 miles)
g limits: flaps up	+3.4/-1.36
flaps down	+2.0

PILATUS PC-12M and SPECTRE

TYPE: Multisensor surveillance turboprop.

PROGRAMME: Announced at Dubai Air Show in November 1995; then named Eagle, but name discontinued in 2002; renamed Spectre in 2003. Second PC-12, HB-FOB, converted as demonstrator (first flight October 1995). Second demonstrator HB-FOG (c/n 134) followed in September 1996 with airframe modifications and different equipment and third HB-FOL (c/n 166) in 1999. New Spectre version unveiled in 2003.

CURRENT VERSIONS: **PC-12M:** Multi-mission variant, formerly named PC-12 Eagle; features enhanced electrical power generator to integrate optional power consuming equipment according to customer requirements. Typical missions include navaid calibration, environmental survey, aerial photography/mapping and medevac, with quick-change facility permitting change of role to cargo, passenger/cargo, VIP transport or medevac in less than three hours. Specific modifications to current demonstrator aircraft are as follows:

HB-FOG: Sensors include WF-160DS IR/E-O system with tracker and Geotrack cueing; Raytheon Sea View SV 1021 radar with ISAR capability 1997 upgrade for SAR; 1998 upgrade for track-while-scan of 100 targets and MTI on SAR; communications digital datalink; 108 n mile (200 km; 124 mile) range video downlink to ground station; and sensor management system.

In late 2001, HB-FOG was delivered to Gruppe Rüstung of Swiss Defence Procurement Agency and based at Emmen for trials connected with new FLORAKO air defence ground environment. Pannier removed and fintip extension not fitted; standard PC-12 winglets. Transferred to Swiss Air Force in 2005. Further special missions upgrades were scheduled to be implemented in 2006/7.

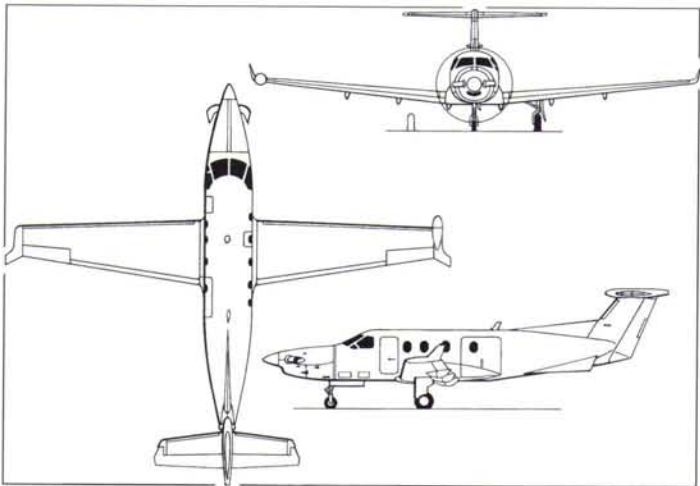
HB-FOL: Modified in 1999 as airborne cellphone relay station, with large ventral pannier, ventral strakes and fintip extension. Sold to customer in 2005.

PC-12 Spectre: Multirole variant; prototype (N146PC), modified and mission equipped by Pilatus Business Aircraft Ltd (PILBAL) of Broomfield, Colorado. Announced 27 July 2003 at Airborne Law Enforcement Association meeting at Wichita, Kansas, having flown earlier that month. First customer was US Bureau of Immigration and Customs



PC-12 (Spectre) ICE surveillance aircraft
(US Bureau of Immigration & Customs Enforcement)

1047204



Pilatus PC-12/47 pressurised light utility and business transport (Mike Keep)

1158189



Cockpit of Pilatus PC-12 Spectre demonstrator N190PE

1158820

Enforcement, Retains PC-12 capabilities, but additionally incorporates retractable turret beneath the non-pressurised part of rear fuselage for FLIR Systems Safire II, or Safire III or Wescam MX-15 sensors and operator's position in cabin with two display monitors, video recorder and audio communications panel with broadband communications link. Spectre does not require aerodynamic modifications (enlarged fin or strakes) although N146PC retained large wingtips; it was sold to a customer in 2005.

Second-generation Spectre demonstrator (N190PE) incorporates a retractable turret beneath the rear fuselage; new ergonomically designed sensor operator's console with three display monitors, digital video recorder, and audio communications panel with downlink capability; and two executive seats, which are part of the Spectre package. Upgrades to the standard PC-12 cockpit include dual Honeywell EFIS 50, Garmin GNS 430/530 NAV/COM/GPS, Honeywell KDR 510 FIS, Honeywell 850 MFD, dual LCR 93 AHRS, Honeywell KMH 980 multi-hazard warning system, Honeywell GNS XLS FMS and L-3 Avionics WX-500 Stormscope. Additional options for the Spectre include a 400-amp generator to power additional mission equipment and a supplemental oxygen system in anticipation of a jump door that was in development in mid-2006.

PC-12 M also capable of carrying such other sensors as 2 to 18 GHz (optionally 40 GHz) elint, including automatic jammer; forward- and backward-looking sensor management systems; a passive missile warning system, including automatic chaff/flare dispensers or active laser countermeasures; radar optimised for land- or sea surveillance; and a bidirectional secure datalink to either land, sea or air units.

From the tenth production Spectre manufactured in 2006, aircraft are equipped with a sensor lift platform that can be equipped with a variety of EO/IR turrets with maximum diameter of 0.41 m (1 ft 4 in). Upgraded Spectre also features new wingtip design that reduces aileron control forces by two-thirds, and 100 kg (220 lb) increase in payload.

CUSTOMERS: One delivered to Swiss Defence Procurement Agency. Other confirmed customers for PC-12M include Argentina's Gendarmeria and Bulgarian Air Force. Pilatus in negotiations with several countries, unconfirmed reports citing Malaysia and Thailand. US Department of Homeland Security, Bureau of Customs and Border Patrol's CBP Air (formerly known as ICE) operates three Spectres; initial aircraft were N541PB in March 2004 and N497PC in June 2004; variant formally announced on 14 May 2004 as replacement for ICE's Beech King Air Fleet.

RUAG

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In 1996, the former Swiss Federal Aircraft Factory Emmen merged with the industrial division of the Swiss Air Force Logistic Command and parts of the Federal Ordnance Office. On 1 January 1999, it was converted from a federal ordnance establishment into a public diversified private company within the RUAG group and renamed Swiss Aircraft and Systems Enterprise Corporation. This title was changed to RUAG Aerospace in 2001, with sites at Emmen, Stans, Zweisimmen, Interlaken, Loderino (Zürich) Airport and Alpnach. In 2006, RUAG Aerospace had 2,700 workforce; factory area totalled 92,000 m² (990,279 sq ft) and office area 25,000 m² (269,098 sq ft). A company turnover of approx CHF520 million (USD416 million) was posted in 2005.

RUAG Aerospace runs operations at several sites and subsidiaries in Switzerland and Germany, and works with customers and business partners throughout the world. The

DESIGN FEATURES: FLIR turret at front of ventral panner; winglets replaced by conventional wingtips (weather radar in starboard tip pod); undertail strakes enlarged (to maximum depth of 53 cm; 21 in) to maintain stability. HB-FOG fitted 1997 with new 'tiplets' (wingtips with small vertical winglets), newly defined undertail strakes and additional fin area above the elevator, increasing overall height by 48 cm (19 in). HB-FOG and HB-FOL fitted with fintip extensions above tailplane which, with ventral strakes, is mandatory if large ventral panner is installed. Can undertake various reconnaissance and surveillance missions, but retains ability to revert to passenger and other missions at short notice.

DIMENSIONS, EXTERNAL: As standard PC-12/47 except: PC-12M:

Wing span 16.27 m (53 ft 4½ in)

Height overall (with fintip extension) 4.26 m (13 ft 11¾ in)

WEIGHTS AND LOADINGS: As standard PC-12/45 except:

Weight empty, Spectre 3,120 kg (6,878 lb)

Max payload 1,640 kg (3,616 lb)

PERFORMANCE:

Max cruising speed at FL260:

Spectre 270 kt (500 km/h; 311 mph)

Stalling speed, flaps and gear down 66 kt (122 km/h; 76 mph) IAS

Max rate of climb at SL 480 m (1,575 ft)/min

Max operating altitude 9,145 m (30,000 ft)

Max range at FL260 at 200 kt (370 km/h; 230 mph), 45 min reserves: PC-12 Spectre 1,633 n miles (3,080 km; 1,913 miles)

Time on station, two pilots, max fuel, loiter speed of 110 kt (203 km/h; 129 mph) with

30 min reserves:

at FL50 7 h 35 min

at FL100 8 h 32 min

at FL150 9 h 24 min

at FL200 10 h 15 min

know-how and core competencies are based on more than 60 years of broad experience in development, production and maintenance of aircraft, helicopters, missiles and space products.

RUAG Aerospace's main activities are represented by four operating divisions: Military Aircraft, Commercial Aircraft, Space and Systems, and Aerostructures.

In the field of military aircraft the activities include maintenance, repair, system improvements and final assembly of F/A-18 fighters and Super Puma helicopters for the Swiss Air Force, as well as modernisation of the Bell UH-1D helicopter for the German armed forces.

Services for commercial aircraft comprise maintenance, repair, overhaul, painting, system improvements and completion of business and regional aircraft. A collaboration agreement with EADS Defence Electronics of Ulm, Germany, to develop self-protection systems for business jets, was announced in October 2006.

Aerostructures are developed and manufactured for various airframe and engine customers worldwide, using state of the art facilities. For instance, the outer fixed trailing-edges of the Airbus A380 wings are manufactured using the latest high-speed cutting and automated drilling technology.

The Space and Systems Division is responsible for a large number of products and services, both for the military and space markets. The payload fairings for the Ariane and Atlas launchers are examples of space programmes going on for several decades.

RUAG Aerospace is operating three different sizes of wind tunnel, and is offering its competencies in theoretical and experimental aerodynamics to a wide range of customers, mainly from the aeronautical and automotive industries.

First activities in the UAV field date back some 20 years and led to the development, production and experience of the reconnaissance drone system Ranger, now in successful use with the Swiss and Finnish forces.

SWISSCOPTER

SWISSCOPTER SA

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PRESIDENT: Santino Timpano

Swisscopter was continuing to promote its two-seat helicopter in late 2006.

SWISSCOPTER SWISSCOPTER

TYPE: Two-seat light helicopter.

PROGRAMME: Several years in design and development before first flight in June 2002, but this followed by ground resonance problems which destroyed aircraft and delayed further flight testing. Second prototype since flown: was displayed at Dubai air show in November 2005.



Swisscopter on display at Dubai

1158834

when company reported design now virtually vibration-free and ready for orders in 2006. Certification and first deliveries planned for fourth quarter of 2006.

DESIGN FEATURES: Two-blade main and tail rotors; pod and boom fuselage; sweptback upper and lower tailfins, former bearing a T tailplane. Resembles Italian Dragon Fly 333 in its original form. Fuel consumption 20 litres (5.3 US gallons; 4.4 Imp gallons) per hour at 70 per cent power.

Main rotor rpm 520.

FLYING CONTROLS: Conventional and manual.

STRUCTURE: Main frame of titanium and Ergal aluminium alloy; cabin shell of pre-preg carbon fibre, Kevlar, glass fibre/epoxy and Nomex honeycomb.

LANDING GEAR: Twin-skid type on prototypes; wheels option to be offered on production aircraft.

POWER PLANT: Two 750 cc SwissMotor two-cylinder, liquid-cooled four-stroke engines, connected through dedicated flywheel to give combined output of 101.4 kW (136 hp).

FADEC system patent pending in late 2005. Fuel capacity 75 litres (19.8 US gallons; 16.5 Imp gallons).

ACCOMMODATION: Two seats side by side in fully enclosed cabin with window/door each side.

DIMENSIONS, EXTERNAL:

Main rotor diameter 6.70 m (21 ft 11¾ in)

Tail rotor diameter 1.12 m (3 ft 8 in)

Length overall 5.40 m (17 ft 8½ in)

Height: over cabin roof 1.72 m (5 ft 7¾ in)

over main rotor 2.36 m (7 ft 9 in)

DIMENSIONS, INTERNAL:

Cabin max width 1.30 m (4 ft 3¼ in)

AREAS:

Main rotor disc 35.26 m² (379.5 sq ft)

Tail rotor disc 0.98 m² (10.55 sq ft)

WEIGHTS AND LOADINGS:

Weight empty 290 kg (639 lb)

Max T-O weight 600 kg (1,322 lb)

Max disc loading 17.01 kg/m² (3.48 lb/sq ft)

PERFORMANCE (estimated):

Never-exceed speed (V _{NE})	102 kt (190 km/h; 118 mph)
Cruising speed at S/L, 70% power	81 kt (150 km/h; 93 mph)
Max rate of climb at S/L	390 m (1,280 ft)/min

Hovering ceiling: IGE	4,100 m (13,450 ft)
OGE	2,450 m (8,040 ft)
Max range, 20 min reserves	280 n miles (520 km; 323 miles)
Endurance at cruising speed above	3 h 30 min

SWISS LIGHT

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JOINT PRESIDENTS:

Goldiwil B. Thun

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Swiss Light Aircraft, formed on 3 February 2006 by three former WD customers and the company's Swiss representative, purchased the rights to the WD series of light aircraft following the latter's bankruptcy. The company expected to restart production of the Fascination D4 BK and VLA (with slight redesigns) during that year, with development on the Evolution D5 continuing. No announcement had been made regarding the Revolution D6 competition aerobatic aircraft at the time of the purchase.

Final assembly of the aircraft is likely to be undertaken in Germany.

SWISS LIGHT D4 BK FASCINATION

TYPE: Side-by-side ultralight/kitbuilt.

PROGRAMME: Original D4, of steel, wood, fabric and composites construction, designed by Jaroslav Sedáček of UL-JIH in Czech Republic; first flew in early 1996; marketed until 2006 by WD Flugzeugleichtbau of Germany; public debut (D-MOVE and D-MBWH) at the Réseau du Sport de l'Air rally at Epinal, France, in July 1996. Prototype D4 BK (D-MPMM, carrying spurious registration D-MMMU) exhibited at Aero '99, Friedrichshafen, in April 1999, shortly before maiden flight; US debut at EAA Air Venture at Oshkosh, Wisconsin, in July 2000. Production ceased 2005 with WD's bankruptcy; was due to restart late 2006.

CURRENT VERSIONS: **D4:** Initial version, last described in 1999 2000 edition. Total of 41 completed.

D4 BK: All-composites version, as described. BK indicates *bugrad, kraftstoff*; nosewheel, composites.

D4 Fascination VLA: Revealed at Aero '03 in mockup form; at which time certification was expected in third quarter of 2003; prototype (D-EVLA) first flew 4 October 2003 and type certificate EASA.A.019 issued 13 December 2004. Around 40 changes made compared to D4 BK; dimensions as D4 BK, except length overall 6.87 m (22 ft 6½ in). Further minor design changes envisaged by Swiss Light Aircraft.

D4 Fascination LSA: US market; generally as VLA, but fixed-pitch propeller.

D5: High-wing version; described separately.

CUSTOMERS: More than 200 sold by August 2006.

COSTS: Fully equipped D4 BK EUR84,000 excluding tax. Kit version EUR56,450 excluding tax; VLA EUR110,000 (all 2005).

DESIGN FEATURES: Wings and tail surfaces detach for storage/transport. Quoted kit build time 800 hours.

FLYING CONTROLS: Conventional and manual. Balance tabs suspended beneath each aileron; aileron gaps sealed. Horn-balanced rudder, Fowler flaps.

STRUCTURE: All composites.

LANDING GEAR: Standard fixed tricycle type, with nosewheel power steering. Fuselage-mounted spring cantilever mainwheel legs. Retractable optional; main units retract outwards, nosewheel rearwards. Cable-operated disc brakes.

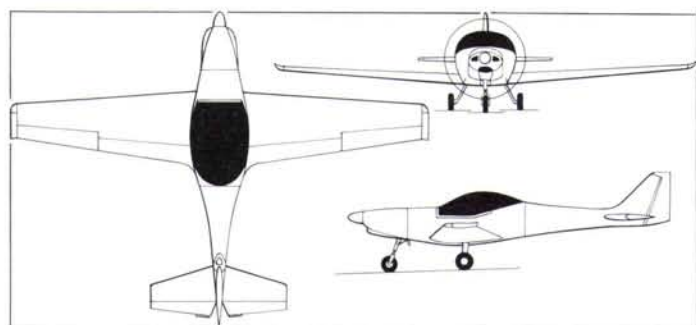
POWER PLANT: One 59.6 kW (79.9 hp) Rotax 912 UL (standard), 73.5 kW (98.6 hp) Rotax 912 ULS (optional) or (on completion of development) 86.8 kW (116.3 hp) DZ 100 flat-four engine driving a Rospeller two-blade (912 UL) or three-blade (912 ULS) constant-speed (electric) propeller. Fuel capacity 90 litres (23.8 US gallons; 19.8 Imp gallons).

D4 Fascination VLA: One 73.5 kW (98.6 hp) Rotax 912 ULS driving a three-blade constant-speed (electric) propeller. Fuel capacity 180 litres (47.6 US gallons; 39.6 Imp gallons).



VLA version of Swiss Aircraft Fascination (Paul Jackson)

1159356



General arrangement of Swiss Light Aircraft Fascination D4 BK (James Goulding)

1133247

AVIONICS: GPS and transponder optional.

EQUIPMENT: Ballistic recovery parachute optional.

DIMENSIONS, EXTERNAL:

Wing span	9.00 m (29 ft 6¼ in)
Length overall	6.98 m (22 ft 10¼ in)
Height overall	1.85 m (6 ft 0¾ in)

DIMENSIONS, INTERNAL:

Cockpit max width	1.14 m (3 ft 9 in)
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AREAS:

Wings, gross	12.70 m² (136.7 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty: BK	290 kg (639 lb)
VLA	350 kg (772 lb)
Max T-O weight: BK	450 kg (992 lb)
VLA	650 kg (1,433 lb)

PERFORMANCE (Rotax 912 ULS):

Never-exceed speed: BK	157 kt (290 km/h; 180 mph)
VLA	151 kt (279 km/h; 173 mph)
Cruising speed: BK	145 kt (269 km/h; 167 mph)
VLA	140 kt (259 km/h; 161 mph)
Stalling speed: BK	35 kt (64 km/h; 40 mph)
VLA	45 kt (84 km/h; 52 mph)
Max rate of climb at S/L: BK	420 m (1,378 ft)/min
VLA	335 m (1,100 ft)/min
T-O run: BK	77 m (250 ft)
VLA	90 m (295 ft)
Landing run: BK	100 m (330 ft)
VLA	130 m (430 ft)
Range with max fuel: BK	783 n miles (1,450 km; 901 miles)
VLA	1,100 n miles (2,037 km; 1,265 miles)

SWISS LIGHT D5 EVOLUTION

US marketing name: AveoSport WD

TYPE: Side-by-side, ultralight/kitbuilt.

PROGRAMME: Announced at Aero '01 at Friedrichshafen April 2001; first flight of prototype (D-MPMM) then expected within two months but not achieved until 16 February 2002.

Series production began in 2002.

CUSTOMERS: At least six built by 2005.

COSTS: Fast-build kit EUR65,450; flyaway EUR92,580; both excluding tax (2005).

DESIGN FEATURES: Utilises wings, Fowler flaps and tail surfaces of D4 Fascination. 'Glass cockpit'. Wings and tail surfaces detach for storage and transportation.

FLYING CONTROLS: Conventional and manual. Dual controls standard. Fowler flaps.

STRUCTURE: Primarily composites, with metal landing gear doors.

LANDING GEAR: Tricycle type; retractable. All three units retract rearwards, with main legs housed within lower fuselage.

POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS driving Rospeller three-blade constant-speed propeller via 1:1.43 reduction gearing. Fuel capacity 120 litres (31.7 US gallons; 26.4 Imp gallons).

EQUIPMENT: Ballistic parachute recovery system optional.

DIMENSIONS, EXTERNAL:

Wing span	9.10 m (29 ft 10¼ in)
Length overall	6.62 m (21 ft 8½ in)
Height overall	2.04 m (6 ft 8¼ in)

DIMENSIONS, INTERNAL:

Cabin max width	1.25 m (4 ft 1¼ in)
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AREAS:

Wings, gross	10.40 m² (111.9 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	290 kg (639 lb)
Max T-O weight	475 kg (1,047 lb)

PERFORMANCE (Rotax 912 ULS):

Max level speed	157 kt (290 km/h; 180 mph)
Cruising speed	146 kt (270 km/h; 168 mph)
Stalling speed	35 kt (64 km/h; 40 mph)
Max rate of climb at S/L	510 m (1,673 ft)/min
T-O run: solo	75 m (246 ft)
dual	100 m (330 ft)
Range	944 n miles (1,750 km; 1,087 miles)

SWISS LIGHT REVOLUTION

TYPE: Tandem-seat sportplane kitbuilt.

PROGRAMME: Under development by 2005; scale flying model shown at Aero '05, Friedrichshafen, April 2005. To be manufactured by UL-JIH in Czech Republic. First flight was due in 2005 but did not happen due to WD's bankruptcy. Programme status unclear under new owner.



Swiss Light (WD) D5 Evolution (Paul Jackson)

1159357

Taiwan

AIDC

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VICE-PRESIDENT, BUSINESS: Chou Yeuan-Yuan

MANAGER, PUBLIC RELATIONS: Michael H L Chang

Established 1 March 1969; became subsidiary of Chung Shan Institute of Science and Technology (CSIST) under Ministry of National Defense on 1 January 1983 and known as Aero Industry Development Center until June 1996. New 35,700 m² (384,270 sq ft) assembly facility opened in 1989. Current facilities at Taichung (28.53 ha), Kang Shan (19.16 ha) and Sha Lu (72.12 ha); total site area 119.81 ha (296.1 acres); workforce was 4,400 in mid-2001.

From 1 July 1996 was officially transferred under Ministry of Economic Affairs with title as above; completed production of IDF Ching-Kuo fighter in January 2000. AIDC is a participant (with 5 per cent share) in the Sikorsky S-92 Helibus (which see), responsible for the cockpit structure, and (from 1999) is sole-source supplier of crew and passenger doors for the S-76. Other subcontract work includes wing design and manufacture of the Ibis Aerospace Ae 270 (10 sets produced by August 2004, when production suspended); Airbus A321

(subassemblies); Boeing 747 (cabin doors); Boeing 737 (cabin and landing gear doors); Alenia C-27J Spartan (tail unit); and Bombardier Challenger 300 (rear fuselage and tail unit). Assembled 13 Bell OH-58Ds for Republic of China Army (first one delivered 16 November 1999; last in third quarter 2001). It also participates in such programmes as the Lockheed Martin F-16 combat aircraft, and the Honeywell TFE1042 and Rolls-Royce 601K gas-turbine engines. However, despite this range of work, AIDC revenue had reportedly shrunk from about USD750 million in 1999 to less than USD300 million in 2001, and additional subcontract work was sought in 2002. Bell offered AIDC a share in manufacture (tailbooms, elevators and engine cowlings) of AH-1Z and UH-1Y in September 2003, leading to agreement 27 February 2004 for initial low-rate production of 53 tailbooms and elevators, with engine cowlings contracted elsewhere. Under same agreement, AIDC to become upgrade centre for Taiwan's existing AH-1W fleet, and will be future certified maintenance centre for these aircraft. Future attack helicopter competition for Taiwan pits AH-1Z against AH-64D Apache Longbow; down-selection of winner still awaited in late 2006; up to 75 required, but armed version of Sikorsky S-70A Black Hawk reported to also be in contention at this time.

As a government-owned commercial entity, AIDC is dedicated to research and development for Taiwan's aerospace industry (military and commercial aircraft). Full privatisation, originally planned for fourth quarter of 1999, has been repeatedly postponed following a mid-2000 company restructuring based on three core activities: defence systems and technologies, aerostructures and engines. In 2002, Taiwan government set a 'must keep' privatisation deadline of December 2003, but by then had again deferred a decision by a further year or more. Further restructuring begun in July 2004 under new five-year business plan, leading to reduction in number of separate divisions from 58 to 27.

YOSHINE

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PRESIDENT: Charles Lin

Yoshine, which is a sister company of Modus Vertcraft, was established to develop a safer personal helicopter equipped with a coaxial rotor. An agreement was reached with LA Systems of the UK to set up EzyCopter UK Ltd as a dealer/distributor in mid-2004. Other distributors include Helitrade (Italy), Plasgold (Philippines) and Remax (US).

YOSHINE EZYCOPTER

TYPE: Single-seat ultralight helicopter kitbuilt.

PROGRAMME: As of mid-2004, first of two AIDC-built prototypes was due to fly in fourth quarter of that year, and at least one has done so. Promoted also as a UAV, following a first flight in unmanned form on 24 January 2005. Production of the piloted version was planned to begin in 2005, but no evidence of kit production seen by late 2006, despite reports in 2004 of 'advance orders' for 300.

COSTS: Kit USD50,000 (2004).

DESIGN FEATURES: Few details released. Employs Yoshine YX-24 coaxial and contra-rotating rotor head with twin two-blade semi-rigid rotors. No tail rotor.

FLYING CONTROLS: Standard collective and cyclic pitch controls.

LANDING GEAR: Twin-skid type.

POWER PLANT: Offered in 2006, with following options: two 37.3 kW (50 hp) KR-RX50 single-rotor rotary engines; two 48.5 kW (65 hp) Hirth H32 two-cylinder two-strokes; or two 33.6 kW (45 hp) Mz 201 or 44.7 kW (60 hp) Mz 202 two-cylinder two-strokes.



EzyCopter in unmanned flight

1129246

DIMENSIONS, EXTERNAL:

Rotor diameter	4.50 m (14 ft 9¼ in)
Length overall	3.90 m (12 ft 9½ in)
Height overall	2.50 m (8 ft 2½ in)
Skid track	1.80 m (5 ft 10¾ in)

AREAS:

Rotor disc	15.90 m ² (171.1 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	180 kg (397 lb)
Max T-O weight	300 kg (661 lb)

PERFORMANCE:

Max cruising speed	65 kt (120 km/h; 75 mph)
Econ cruising speed	43 kt (80 km/h; 50 mph)
Hovering ceiling: IGE	2,000 m (6,560 ft)
OGE	1,000 m (3,280 ft)
Endurance	2 h

Turkey

ALP

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Web: www.alp.com.tr

CHAIRMAN: Tuncer Alpata

MANAGING DIRECTOR: Senay Idil

Formed 29 July 1999 as joint venture company by Sikorsky Aircraft Turkey Inc and The Alpata Group (50 per cent each) to manufacture high-technology, precision-machined aerospace and defence components and assemblies for global market in modern 6,500 m² (70,000 sq ft) facility: site area approx 34,000 m² (36,600 sq ft). Company has 26 CNC machine tools and 2004 workforce of 142. Revenue for 2004 was USD6.5 million.

Alp manufactures components for both aircraft and aero-engines, including Sikorsky S-70 Black Hawk and Seahawk, S-76 and S-92, Boeing 737 and Lockheed Martin F-135 Joint Strike Fighter. As of 2006 it had 11 international and domestic customers, including Sikorsky Aircraft, Pratt & Whitney, Kaman Aerospace, Aero Vodochody and Goodrich Landing Gear Systems.

TAI

TURKISH AEROSPACE INDUSTRIES (TUSAS HAVACILIK VE UZAY SANAYII A S)

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Ahmet Metan (Business Development)

Özcan Ertem (Design and Engineering)

Bekir Ata Yilmaz (Programmes)

Ahmet Tokmakcioglu (Quality Assurance Group Manager)

Oktay Ince (Information Technologies Manager)

MARKETING MANAGER: Yilmaz Guldoğan

PUBLIC RELATIONS CO-ORDINATOR: Nursel Köran

PUBLIC RELATIONS SPECIALIST: Mrs Bican Çelik Ates

Tusas Aerospace Industries Inc (TAI), the centre of technology in design, development, manufacturing, integration of aerospace systems, modernisation and after-sales support in Turkey, was established under the Turkish Commercial Code and Foreign Investment Encouragement Law on 15 May 1984. At the 'share Purchase Agreement' signing ceremony held at TAI facilities on 12 January 2005, Lockheed Martin of Turkey Inc (42 per cent) and

General Electric International Inc (7 per cent) shares of TAI were transferred to Turkish Aircraft Industries Inc (Tusas), Turkish Aircraft Industries Inc (Tusas) and Tusas Aerospace Industries Inc (TAI) merged under the roof of TAI on 28 April 2005. The shareholders of the company are: Turkish Armed Forces Strengthening Foundation (TSKGV); Undersecretariat for Defense Industries (SSM); and Turkish Aeronautical Association (THK). Workforce in March 2006 was 2,184.

Located in Ankara, TAI facilities cover an area of 500 ha (1,235 acres) with an industrial facility of 150,000 m² (1.6 million sq ft) under roof. The company has a modern aircraft facility furnished with high technology machinery and equipment that provide extensive manufacturing capabilities ranging from parts manufacturing to aircraft assembly, flight tests and delivery. Quality system of the company meets the stringent world standards including NATO AQAP-110, ISO-9001:2000, AS EN 9100 and AECMA-EASE.

TAI's experience includes co-production of F-16 fighters, CN-235 light transport/maritime patrol/surveillance aircraft, SF-260 trainers, Cougar AS 532 search and rescue (SAR), combat search and rescue (CSAR) and utility helicopters as well as design and development of unmanned aerial vehicles, target drones and agricultural aircraft. Moreover TAI is the prime contractor of the Turkish unmanned aerial vehicle programme.

TAI's core business also includes modernisation, modification and systems integration programmes and after-sales support of both fixed- and rotary-wing military and commercial aircraft in the inventory of Turkey and friendly countries. Major programmes are electronic warfare retrofit and structural modifications on TuAF F-16s, modification of the S-2E Tracker maritime patrol aircraft into fire fighting aircraft, Black Hawk modifications for Special Forces, modification of CN-235 platforms for MPA/MSA missions for the Turkish Navy and Coast Guard, modification and modernisation of Cougar AS 532, 'glass cockpit retrofit of S-70 helicopters, as well as structural modification and systems integration activities required for the conversion of B737-700 aircraft into AEW&C aircraft. By utilising capabilities of the Turkish Armed Forces' Maintenance Centres, TAI also gives maintenance, repair and overhaul services to its customers.

TAI is engaged in manufacturing aerostructures for fixed- and rotary-wing, military and commercial aircraft for worldwide customers. The company's experience in the aircraft and aerostructures manufacturing business makes it a uniquely qualified partner of Agusta, Airbus, Boeing, CASA, Eurocopter, Lockheed Martin, Northrop Grumman, Sikorsky, Sonaca and many more. TAI manufactures section 18 fuselage panels for Airbus A319/320/321, wingtips and flight deck panels for Boeing 737, rear doors and engine cowlings for Eurocopter EC-135 helicopters, horizontal stabilisers, tail rotor pylons and tailbooms for Sikorsky S-70A and MH-60 helicopters, horizontal stabilisers for Sikorsky S-76 helicopters and AB139 fuselages for Agusta. Furthermore, TAI, which manufactures nose landing gear doors for B747, dorsal fin for B777 and parts/subassembly parts for B737/767/777, manufactures seven components of the Cougar AS-532.

As a full member of Airbus Military SAS, TAI is engaged (7.15 per cent work share) in the development of the A-400M, for which it will produce forward centre and rear upper fuselages, ailerons, spoilers, paratroop doors, hatches and tailcone. Its first components for this programme were shipped to Bremen in 2006: a rear fuselage upper shell on 4 April and a forward centre fuselage on 7 July. In 2002 it became the seventh international participant in the Lockheed Martin JSF programme.

TAI HURKUS

TYPE: Basic turboprop trainer.
PROGRAMME: Primary Trainer Aircraft Design and Development protocol signed 28 September 2005 by Undersecretariat for Defence Industries (SSM) and TAI, initiating eight-month design phase. However, this superseded by new protocol of 15 March 2006, now retitled Primary and Basic Trainer Aircraft Development Programme, starting eight-month conceptual design phase of an overall 59-month programme. Latter calls for two flying and two static/fatigue test prototypes. Named in December 2006 after Vecihi Hürkuş, a veteran contributor to Turkish aviation history, marking beginning of preliminary design phase.
DESIGN FEATURES: Specification calls for a single-turboprop aircraft with tandem seating, zero/zero ejection seats, pressurised cockpits, anti-g and oxygen systems, and ability to perform primary and basic training functions of SF-260 and T-37. Objectives include EASA certification and export sales.



Conceptual profile of TAI primary/basic trainer 1158856

Ukraine

AEROKOPTER

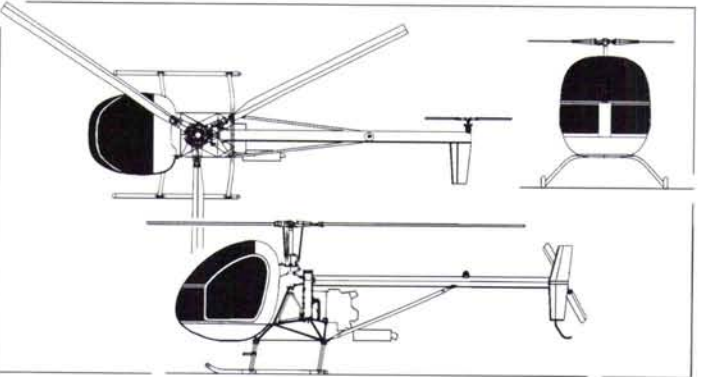
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Web: www.copter.com.ua
SALES DIRECTOR: Aleks Miroshnichenko

Aerokopter was established on 14 December 1999 by I V Polituchy, A N Zapishny and A I Polituchy to develop light rotorcraft. It was briefly associated with what, on 3 May 2000, became the separate Aviaimpex design bureau, also active in Ukraine. First product was ZA-6 (or AK1-5) San'ka proof-of-concept light helicopter, now known to have flown for the first time on 12 October 2001.
Factory floor area 1,200 m² (12,900 sq ft).

AEROKOPTER AK1-3
TYPE: Two-seat helicopter/kitbuilt.
PROGRAMME: Derived from company's ZA-6 San'ka demonstrator via five-blade AK1-5 (GL-0478), which was shown at Manufacturing & Security Exhibition, Kiev, September 2002, but did not proceed further. Incomplete AK1-3 prototype shown at same event, eventually flying in July 2003.
South African marketing began in 2006, for import only in factory-built guise.
CURRENT VERSIONS: **AK1-3**: As described.
AK1-3SKh: Agricultural version with spraybars and tank. Promoted in West as AK1-3CX, the untransliterated cyrillic designation.
CUSTOMERS: First production batch of five began in 2005. Target manufacture of 10 in 2006, including five earmarked for South Africa.
COSTS: USD135,000 flyaway; USD110,000 kit (both 2006).
DESIGN FEATURES: Pod-and-boom configuration with three-blade, bearingless main rotor and two-blade anti-torque rotor to starboard. Conforms to AP-27 certification criteria, Service life 2,000 hours.
Power transfer from engine to conical reduction gear drive-shaft via seven V-belts,



Aerokopter AK1-3 light helicopter 1159007



Aerokopter AK1-3 (Subaru EJ-25 engine) (Paul Jackson) 1128986

flexible rubber clutch and freewheel roller clutch. Reduction gearbox at tail rotor.
Main rotor blade section NACA 63012/63015; non-linear twist -9° 30'; tip velocity 205 m (673 ft/s). Tail rotor blade section NACA 63012; tip velocity 186 m (610 ft/s).
FLYING CONTROLS: Conventional and manual.
STRUCTURE: Main rotor blades of T-25 glass fibre; tail rotor of metal alloy and Rohacell styrofoam. Airframe basic structure, including skids, of welded 30 HGSA GOST 4543-86 steel, plus D-16T GOST 4784-97 alloy and VT3-1 GOST 19807-91 titanium; pod of carbon-Kevlar cloth, with acrylic transparencies and 16 mm (5/8 in) plywood floor; steel rotor hubs; tailboom of riveted steel plate.
LANDING GEAR: Skid type; fixed.
POWER PLANT: One 123 kW (165 hp) Subaru EJ-25 liquid-cooled, flat-four piston engine. Fuel tank between engine and cockpit; capacity 80 litres (21.1 US gallons; 17.6 Imp gallons) of which 75 litres (19.8 US gallons; 16.5 Imp gallons) usable.
ACCOMMODATION: Two crew, side by side on fixed seats. Cockpit heated and ventilated.
SYSTEMS: Electrical system 12 V and 27 V DC, plus 36 V 400 Hz three-phase AC, with 70 A generator and 60 Ah battery.
DIMENSIONS, EXTERNAL:
Main rotor diameter 6.84 m (22 ft 5/4 in)
Main rotor blade chord 0.17 m (6 3/4 in)
Tail rotor diameter 1.29 m (4 ft 2 3/4 in)
Tail rotor blade chord 0.115 m (4 1/2 in)
Length: overall, rotors turning 8.095 m (26 ft 6 3/4 in)
fuselage 5.805 m (19 ft 0 1/2 in)
Height overall 2.27 m (7 ft 5 1/4 in)
Skid track 1.645 m (5 ft 4 3/4 in)
Skid length 1.825 m (5 ft 11 3/4 in)
Distance between rotor centres 4.025 m (13 ft 2 1/2 in)
Doors (two): Max height 1.00 m (3 ft 3 1/4 in)
Max width 0.95 m (3 ft 1 1/2 in)
DIMENSIONS, INTERNAL:
Cockpit: Length 1.50 m (4 ft 11 in)
Max width 1.355 m (4 ft 5 1/4 in)
Max height 1.20 m (3 ft 11 1/4 in)
AREAS:
Main rotor disc 36.75 m² (396 sq ft)

Tail rotor disc	1.29 m ² (13.89 sq ft)
Fins (total)	0.27 m ² (2.91 sq ft)
Horizontal stabilisers (total)	0.15m ² (1.61 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	380 kg (838 lb)
Max T-O weight	650 kg (1,433 lb)
Max zero-fuel weight	590 kg (1,301 lb)
PERFORMANCE:	
Never-exceed speed (VNE)	102 kt (189 km/h; 117 mph)
Max operating speed	100 kt (186 km/h; 115 mph)

Cruising speed: at 75% power	85 kt (157 km/h; 98 mph)
econ	65 kt (120 km/h; 75 mph)
Max rate of climb at S/L	540 m (1,771 ft)/min
Hovering ceiling: IGE	2,320 m (7,620 ft)
OGE	1,800 m (5,905 ft)
Service ceiling	5,150 m (16,900 ft)
Range: at 75% power	172 n miles (320 km; 198 miles)
at econ speed	189 n miles (350 km; 217 miles)
g limits	+0.5/+2.5

AEROPRAKT

AEROPRAKT OOO (AEROPRAKT LTD)

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SALES MANAGER: Shawn Okun

Aeroprakt was formed in Kiev in 1986, after Yuri Yakovlev, who had designed the T-8 lightplane for the Aeroprakt organisation of Samara, Russia, was invited to work at Antonov ASTC. Yakovlev then produced the A-20 Chervonets and joined with fellow engineer Oleg Litovchenko in an initially part-time venture. Established in present, commercial form in 1991. Retaining the 'k for Kiev' in its name, the company now employs only even-numbered designations for its aircraft, the latest to fly being the A-28. Company has agencies in Australia, Belgium, Canada, Denmark, Germany, Iran, Italy, Latvia, New Zealand, Poland, Russia, South Africa, Spain, Turkey, UAE, UK and USA.

Design and production personnel total 50; factory space 2,000 m² (21,525 sq ft), although some production subcontracted to Aviant and Antonov. Test and associated flying club airfield at Nalivaykovka. More than 100 Aeroprakt aircraft have been constructed and the A-20 continues in production.

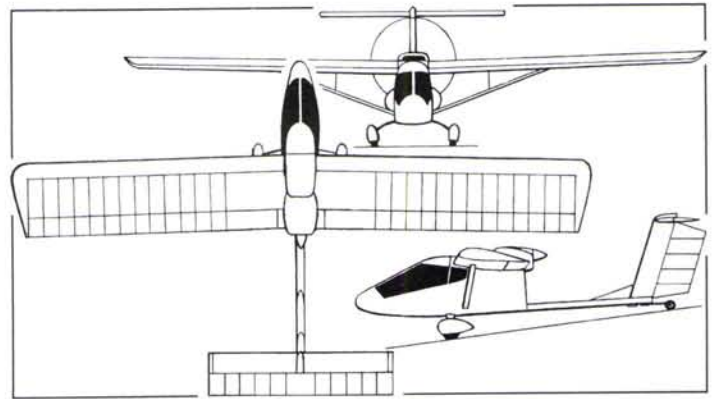
AEROPRAKT-20R912 SKY CRUISER

US marketing names: Vista Cruiser and Varlet

TYPE: Tandem-seat ultralight/kitbuilt.

PROGRAMME: Design started September 1990; Aeroprakt-20 powered by 37.0 kW (49.6 hp) Rotax 503; construction of prototype began November 1990; first flight 5 August 1991; construction of first production aircraft started September 1991, first flown 15 August 1993; prototype appeared abroad for first time in Hodkovice, Czech Republic, at European Microlight Championship, August 1993, gaining ninth place; fourth production A-20 won third place at World Microlight Championship, Poznan, Poland, August 1994; seventh production A-20 gained second place at EMC '95, Little Rissington, UK; initial production aircraft was placed first at EMC, Hungary, 2002.

Increased engine power provided by flat-four Rotax 912 produced A20-R912, alternatively designated Aeroprakt-20M. Construction of prototype Sky Cruiser began



Aeroprakt-20 general arrangement (James Goulding)

1158778



SA-20 Vista (Paul Jackson)

0525065

February 1997; first flight 11 May 1997. Gained second place in 1st World Air Games, Turkey, September 1997; second place in 1998 World Microlight Cup, Hungary; and third place, 2nd World Air Games, Spain.

CURRENT VERSIONS: **Vista Cruiser:** Baseline version. As described.

CUSTOMERS: First customer delivery of A-20 in August 1993; exports to Czech Republic, Germany, Hungary, Jordan, Poland, Russia, Singapore and United Arab Emirates; last-



Spectrum Aircraft SA-20 Vista Cruiser

1151715

mentioned acquired seven for Umm-al Qaiwain Flying Club. Total of 47 A-20s of all types produced by early 2006, including 13 of A-20R912 version.
COSTS: Quick-build kit (40 hours) including engine, propeller and instruments (2004): Vista Cruiser, USD48,500; Super Cruiser USD51,000; Varlet USD57,800 (2005).
DESIGN FEATURES: High-wing, T-tail configuration, optimised for rapid disassembly for transport by trailer. Tail surfaces mounted on aluminium tube which detaches at joint with the nacelle.

Unswept wing on A-20; P-IIIa-15 wing section, thickness/chord ratio 15 per cent; chamfered tips; dihedral 1° 30'; incidence at roots 3° 30'; twist 3°.
A-20R912 has increased power, shorter wing and tailplane spans, engine cowling, constant-speed propeller, fully balanced control surfaces, smaller wheels and more streamlined wing struts and landing gear. Sweepback 1° 30'.
FLYING CONTROLS: Manual. Single-piece, rod-operated flaperons extend full length of wing trailing-edge; no tabs. Single-piece, horn-balanced elevator with protruding, in-flight adjustable tab. Full-height rudder with no tab.

STRUCTURE: Riveted aluminium wing structure; leading-edge D box closed by I-section main spar; stamped wing ribs; bent sheet rear false spar; partially fabric covered. Control surfaces similar to wings. All-composites honeycomb sandwich fuselage pod.
LANDING GEAR: Tailwheel type; fixed. Fuselage-mounted spring cantilever mainwheel legs with wheel fairings. Steerable tailwheel.

POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS flat-four driving a three-blade Ivoprop constant-speed propeller. Standard fuel capacity (US versions) 85 litres (22.5 US gallons; 18.7 Imp gallons). Optional capacity 128 litres (33.8 US gallons; 28.8 Imp gallons).
EQUIPMENT: Ballistic recovery parachute.

DIMENSIONS, EXTERNAL:
Wing span 10.17 m (33 ft 4½ in)
Length overall 6.72 m (22 ft 0½ in)
Height: cabin roof 1.68 m (5 ft 6¼ in)
propeller turning 2.33 m (7 ft 7¾ in)
DIMENSIONS, INTERNAL:
Cockpit max width 0.64 m (2 ft 1¼ in)

AREAS:
Wings, gross 14.00 m² (150.7 sq ft)

WEIGHTS AND LOADINGS:
Weight empty 249 kg (550 lb)
Max T-O weight 455 kg (1,003 lb)

PERFORMANCE:
Max level speed 113 kt (210 km/h; 130 mph)
Cruising speed 100 kt (185 km/h; 115 mph)
Stalling speed, landing configuration 30 kt (55 km/h; 34 mph)
Max rate of climb at S/L 360 m (1,181 ft)/min
T-O run 61 m (200 ft)
Landing run 77 m (250 ft)
Range 608 n miles (1,126 km; 700 miles)
Endurance 12 h 0 min
g limits +4/-2

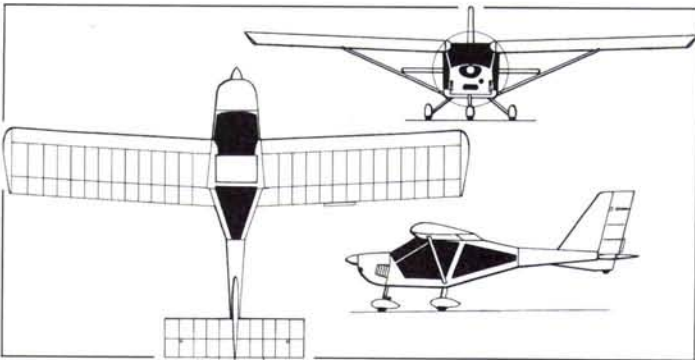
AEROPRAKT-22

French marketing name: Vision
Russian name: Sharik (Balloon)
UK marketing name: Foxbat
US marketing name: Valor

TYPE: Side-by-side ultralight/kitbuilt.
PROGRAMME: Design started February 1990, construction of prototype began September 1994; first flight 21 October 1996; certified to German BFU-95; production began in early 1999 with c/n 003. Approved for kit assembly in UK.
CURRENT VERSIONS: **Aeroprakt-22 Sharik**: Original version, with 59.6 kW (70.9 hp) Rotax 912 UL engine and fuselage fuel tank.

Following versions have uprated engine.
Foxbat: UK version, marketed from 2000 by Small Light Aeroplane Company Ltd and, later, Dragon Aviation (www.foxbat.co.uk). Prototype, G-FBAT (16th airframe) first flown after kit assembly in UK 12 August 2000. BCARS certification in early 2002; by 2006, 20 had been built under auspices of PFA.
Valor: US version. Standard with Rotax 912 UL engine; option of Rotax 912 ULS and 9.44 m (30 ft 11¾ in) wing span. One only by 2006.
Vision: Marketed in France and Belgium by Aerotrophy of Montagu.

Description applies to Valor.
CUSTOMERS: More than 146 A-22s built by early 2006 and delivered to Australia, France, Georgia, Germany, Ireland, Italy, Latvia, Luxembourg, Mexico, New Zealand, Poland, Russia, South Africa, UAE, UK and USA.
COSTS: UK kit cost GBP32,500 including Rotax 912 ULS engine and Newton propeller, builder's assistance, basic instruments and tax (2006). US cost USD58,469 plus tax and shipping, flyaway with Rotax 912 ULS (2006).
DESIGN FEATURES: Constant-chord wings and horizontal tail surfaces. Wings swept forward 2° 30'; P-IIIa-15 wing section, thickness/chord ratio 15 per cent; chamfered tips; dihedral 1° 30'; incidence at root 4°; twist 2° 30'.
FLYING CONTROLS: Manual, by pushrods and cables. Full-span slotted flaperons with trim tab to starboard; single-piece elevator with tab; and sweptback rudder with ground-adjustable tab.
STRUCTURE: Riveted aluminium wing structure; leading-edge D box closed by I-section main spar; stamped wing ribs; bent sheet rear false spar; Ceconite covering on wings (except metal leading-edge), rudder and elevator. Fin and tailplane similar to wings. Anodised



Aeroprakt-22 ultralight (James Goulding)

1158779

aluminium fuselage with profiled sheet and fluted skin, stamped bulkheads, steel and aluminium tubing. Extensive glazing. Glass fibre engine cowling, wheel spats, wing fillets and fintip.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring steel mainwheel legs with wheel fairings. Hydraulic mainwheel brakes. Steerable nosewheel; small tailwheel protects ventral strake from nose-high landings.

POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS or 59.6 kW (79.9 hp) Rotax 912 UL flat-four driving a KievProp three-blade ground-adjustable pitch propeller or (Foxbat) Newton two-blade. Fuel tank in each wingroot; combined capacity 90 litres (23.8 US gallons; 19.8 Imp gallons). Optional capacity 135 litres (35.6 US gallons; 29.7 Imp gallons).

ACCOMMODATION: Two persons, side by side. Large upward-hinged window/door on each side.

EQUIPMENT: Ballistic parachute.
Note that data vary slightly between German, UK and US variants.

DIMENSIONS, EXTERNAL:
Wing span 10.10 m (33 ft 1¾ in)
Length overall 6.30 m (20 ft 8 in)
Height overall 2.40 m (7 ft 10½ in)
Tailplane span 3.00 m (9 ft 10 in)
Propeller diameter 1.68 m (5 ft 6¼ in)

DIMENSIONS, INTERNAL:
Cabin: Length 1.60 m (5 ft 3 in)
Max width 1.30 m (4 ft 3¼ in)
Height 1.10 m (3 ft 7¼ in)

AREAS:
Wings, gross 13.70 m² (147.5 sq ft)

WEIGHTS AND LOADINGS:
Weight empty, equipped 260 kg (573 lb)
Max T-O weight 450 kg (992 lb)

PERFORMANCE (Rotax 912 UL):
Max level speed 92 kt (170 km/h; 106 mph)
Cruising speed 86 kt (160 km/h; 99 mph)
Stalling speed 30 kt (55 km/h; 35 mph)
Max rate of climb at S/L 300 m (984 ft)/min
T-O and landing run 90 m (295 ft)
Range with max fuel 594 n miles (1,100 km; 683 miles)
g limits +4/-2

AEROPRAKT-24

US marketing name: Viking

TYPE: Three-seat amphibian kitbuilt.
PROGRAMME: Design began September 2000; first flight 25 October 2001.
CURRENT VERSIONS: **Viking**: As described

Twin Viking: Twin-engined version; programme currently suspended. Two Rotax 582s, each 47.8 kW (64.1 hp); empty weight 431 kg (950 lb); MTOW 726 kg (1,600 lb); max level speed 87 kt (161 km/h; 100 mph); T-O run 138 m (450 ft); stalling speed 33 kt (62 km/h; 38 mph).

CUSTOMERS: Nine sold by early 2006. US availability to special order only. Fifth aircraft received Canadian registration (C-FGDY) in December 2005; MTOW of this aircraft officially 793 kg (1,750 lb).

COSTS: USD84,995, complete, quick-build, plus tax (2006). Basic kit USD39,000, plus tax (2004).

DESIGN FEATURES: Braced high-wing monoplane, capable of meeting JAR-VLA certification criteria, which not yet pursued. Several detail changes from version promoted in late 1990s, but not built, including weight in Experimental category; single bracing strut and jury strut each side; flying-boat hull with single step; sweptback vertical tail with unswept horizontal surfaces at tip.

Wing section P-IIIa-15; no dihedral; incidence 4° 30' at mean aerodynamic chord; twist -3°.

FLYING CONTROLS: Conventional and manual. Mass-balanced ailerons and elevator; ailerons and flaps separate, and both slotted; flap deflections 10, 20 and 30°. Actuation by pushrods, except cable-operated rudder and elevator trim tab.



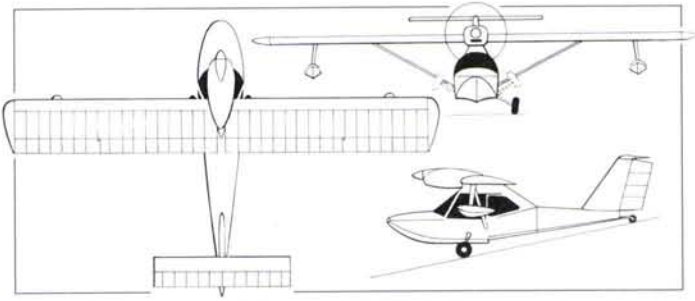
Aeroprakt-24 three-seat amphibian

1158853



Sole Aeroprakt SA-22 Valor on US civil aircraft register (Paul Jackson)

1159070



Aeroprakt-24 kitbuilt amphibian (James Goulding)

0558328

STRUCTURE: Generally as for A-20 and A-22. Hull and integral fin of glass fibre and epoxy resin sandwich with foam core, reinforced by internal bulkheads and beams forming three separate, watertight compartments. Engine and metal wing, with fabric covering, both attached to central, metal box-pylon supported by two stainless steel bracing struts within the cabin. Composites floats constructed integrally with pylons. Metal tailplane with fabric covering.

LANDING GEAR: Tailwheel type, with retractable, but externally stowed, Matco 6.00-6 mainwheels with disc brakes. Faired tailwheel doubles as water rudder. Cantilever spring steel mainwheel legs attached to hull bulkhead. Initial manual retraction replaced by electric motor from 2004. Stabilising float under each outer wing.

POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS or 84.5 kW (113.3 hp) Rotax 914 flat four projecting from wing centre-section. Fuel capacity 87 litres (23.0 US gallons; 19.1 Imp gallons) in tank behind cabin. Optionally, to provide additional baggage capacity, fuselage tank replaced by two wing tanks, combined capacity 90 litres (23.8 US gallons; 19.8 Imp gallons).

ACCOMMODATION: Two seats forward; removable seat at rear of cabin. Sliding door each side openable in flight. Luggage stowage in forward watertight compartment; accessed via door in upper surface.

DIMENSIONS, EXTERNAL:

Wing span	11.12 m (36 ft 5 3/4 in)
Wing chord, constant	1.40 m (4 ft 7 in)
Wing aspect ratio	8.0
Length overall	7.29 m (23 ft 11 in)
Height: top of engine cowlings	2.45 m (8 ft 0 1/2 in)
propeller turning	3.19 m (10 ft 5 1/2 in)
Tailplane span	3.60 m (11 ft 9 3/4 in)
Tailplane chord, constant	0.80 m (2 ft 7 1/2 in)
Wheelbase	4.62 m (15 ft 2 in)
Wheel track	1.60 m (5 ft 3 in)
Propeller diameter	1.70 m (5 ft 7 in)
Cabin doors (each): Height	0.63 m (2 ft 0 3/4 in)
Width	1.00 m (3 ft 3 3/4 in)

DIMENSIONS, INTERNAL:

Cabin: Length	2.20 m (7 ft 2 1/2 in)
Max width	1.10 m (3 ft 7 1/4 in)
Max height	1.20 m (3 ft 11 1/4 in)
Forward baggage hold: Length	0.90 m (2 ft 11 1/2 in)
Max width	1.05 m (3 ft 5 1/4 in)
Max height	0.75 m (2 ft 5 1/2 in)
Volume	0.15 m ³ (5.3 cu ft)

AREAS:

Wings, gross	15.50 m ² (166.8 sq ft)
Ailerons (total)	1.78 m ² (19.16 sq ft)
Trailing edge flaps (total)	2.44 m ² (26.26 sq ft)
Fin	1.05 m ² (11.30 sq ft)
Rudder	0.72 m ² (7.75 sq ft)
Tailplane	2.88 m ² (31.00 sq ft)
Elevator, incl tab	1.44 m ² (15.50 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	440 kg (970 lb)
Max T-O weight	750 kg (1,653 lb)
Max wing loading	50.0 kg/m ² (10.24 lb/sq ft)
Max power loading:	
Rotax 912	10.20 kg/kW (16.76 lb/hp)
Rotax 914	8.88 kg/kW (14.59 lb/hp)

PERFORMANCE:

Never-exceed speed (VNE)	97 kt (180 km/h; 112 mph)
Max level speed	89 kt (165 km/h; 103 mph)
Stalling speed: flaps up	46 kt (85 km/h; 52 mph)
flaps down	38 kt (70 km/h; 43 mph)
Max rate of climb at S/L	240 m (787 ft)/min
Service ceiling	3,500 m (11,480 ft)
T-O and landing run: land	150 m (492 ft)
water	200 m (660 ft)
Range with max fuel	432 n miles (800 km; 497 miles)
Endurance	4 h 30 min
g limits	+4/-2

AEROPRAKT-26

US marketing name: Twin Vista

TYPE: Tandem-seat ultralight twin/kitbuilt.

PROGRAMME: Development of A-20 with two engines; commissioned by Gulf Aviation Technologies; prototype construction began March 1996; first flight 18 November 1997. Initially marketed in US as Vulcan.

CURRENT VERSIONS: **SA-26 Twin Vista:** Lower-powered variant; Rotax 503 engines. Marketed in US by Spectrum Aircraft.

Twin Vista SS: With Rotax 582 engines.

Vulcan: Aeroprakt-36; described separately.

CUSTOMERS: Total 16 sold by 2006 to customers in Guatemala, Panama, UAE and USA. No recent manufacture known.

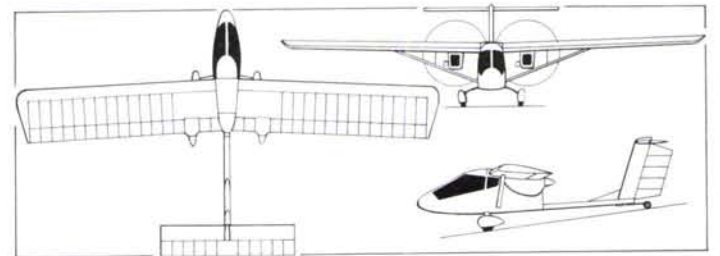
COSTS: Vista SS USD59,999; including engines, propellers, basic digital instruments, paint and fabric (2006).

Description of A-20 applies generally, except as below.



Aeroprakt-26 Twin Vista

1159009



Aeroprakt-26 twin-engine ultralight (James Goulding)

0051502

DESIGN FEATURES: Introduces twin-engine safety margins to A-20 design; able to take off on one engine. Sweepback increased to 3°; tailfin height and rudder chord both increased.

POWER PLANT: Two 47.8 kW (64.1 hp) Rotax 582 UL two-cylinder two-stroke engines, each driving a three-blade, ground-adjustable pitch Ivoprop propeller. Alternatively, two 38.3 kW (51.6 hp) Rotax 462 or 34.0 kW (45.6 hp) Rotax 503 twin-piston engines. Fuel capacity 90 litres (23.8 US gallons; 19.8 Imp gallons) standard; 180 litres (47.5 US gallons; 39.6 Imp gallons) optional in Twin Vista SS.

SYSTEMS: Electrical system with 12 V DC, 14 Ah battery for electric starter.

DIMENSIONS, EXTERNAL:

Wing span	11.34 m (37 ft 2 1/2 in)
Length: fuselage	5.75 m (18 ft 10 1/2 in)
overall	6.72 m (22 ft 0 1/2 in)
Height overall	1.90 m (6 ft 2 3/4 in)
Propeller diameter	1.70 m (5 ft 7 in)

DIMENSIONS, INTERNAL:

Cabin: Length	2.20 m (7 ft 2 1/2 in)
Max width	0.64 m (2 ft 1 1/4 in)
Max height	1.20 m (3 ft 11 1/4 in)

AREAS:

Wings, gross	15.70 m ² (169.0 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty: Twin Vista	300 kg (660 lb)
Twin Vista SS	318 kg (701 lb)
Max T-O weight	550 kg (1,212 lb) ¹

¹ or local ultralight limit

PERFORMANCE (Twin Vista SS):

Max level speed	97 kt (180 km/h; 112 mph)
Normal cruising speed	96 kt (177 km/h; 110 mph)
Stalling speed, landing configuration	30 kt (55 km/h; 34 mph)
Max rate of climb at S/L	549 m (1,800 ft)/min
T-O run	31 m (100 ft)
Landing run	107 m (350 ft)
Range with normal fuel	173 n miles (321 km; 200 miles)
Endurance	6 h 0 min
g limits	+4/-2

AEROPRAKT-30

TYPE: Tandem-seat ultralight.

PROGRAMME: No details officially released, but a photograph has been circulated of (apparently) second prototype LA-3002 showing close similarity to A-20, except for a three-blade scimitar propeller.



Aeroprakt-30 registered LA-3002

1158851

AEROPRAKT-36

US marketing name: Vulcan

TYPE: Tandem-seat twin/kitbuilt.

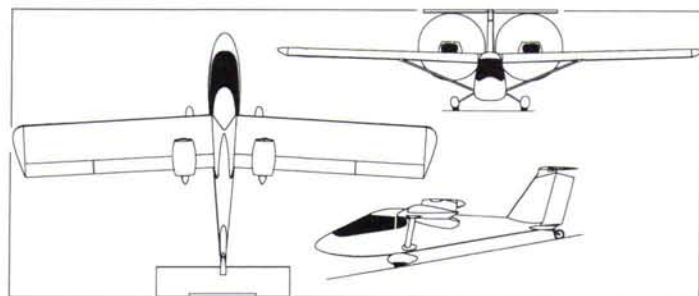
PROGRAMME: Commissioned by Spectrum Aircraft of US in February 2002; design began September 2002; cockpit mockup approved December 2002; assembly of prototype began May 2003; first flight, at Nalivaykovka, 19 September 2004. Kit-deliveries began immediately. Promoted at AirVenture, Oshkosh, July 2003. Development of Aeroprakt-26 Vulcan.

CUSTOMERS: Two orders from UAE, of which one delivered by 2006.



Prototype Aeroprakt-36 Vulcan

1159010



Aeroprakt-36 Vulcan (Paul Jackson)

0580702

COSTS: USD118,000, plus tax (2006).

DESIGN FEATURES: Generally as for A-26, but with two close-centreline-thrust engines.

Wing section P-IIIa-15; dihedral 1° 30'; incidence 2° 30' at mean aerodynamic chord; twist 3°; sweptback 3°.

FLYING CONTROLS: Manual, mass-balanced ailerons, rudder and all-moving tailplane with integral, electric anti-balance/trim tab. Flaps: deflections 10, 20, 30 and 40°. Actuation by pushrods, except cables for mid-portion of tailplane linkage.

STRUCTURE: Single-spar, strut-braced wing of aluminium alloy with steel fittings; composites wingtip and leading-edge, latter forming fuel tank; aluminium alloy bracing struts with composites end fairings. Forward and centre fuselage of glass fibre and foam sandwich monocoque, reinforced by bulkheads and beams, with frames and stringers, plus integral fin and rudder, both of aluminium. Single-spar, all-moving tailplane of aluminium, except composites mass-balance fairing. All control surfaces aluminium-skinned.

LANDING GEAR: Tailwheel type; fixed. Fuselage-mounted, spring cantilever mainwheel legs with speed fairings and Matco 6.00-6 wheels with disc brakes. Steerable tailwheel: 3.00-4.

POWER PLANT: Two 73.5 kW (98.6 hp) Rotax 912 ULS flat-four piston engines driving two-blade, pusher propellers. Fuel tanks in inboard wing leading edges, combined capacity 120 litres (31.7 US gallons; 26.4 Imp gallons).

ACCOMMODATION: Two in tandem. Starboard-hinged canopy replaceable by stub windscreen for open-cockpit flying. Rear baggage compartment with 56 cm (1 ft 6 in) square external door, port.

DIMENSIONS, EXTERNAL:

Wing span	11.395 m (37 ft 4 1/2 in)
Wing chord, constant	1.40 m (4 ft 7 in)
Wing aspect ratio	8.4
Length: fuselage	7.10 m (23 ft 3 1/2 in)
overall	7.34 m (24 ft 1 in)
Height overall	2.30 m (7 ft 6 1/2 in)
Tailplane span	3.60 m (11 ft 9 3/4 in)
Propeller diameter	1.80 m (5 ft 10 3/4 in)

DIMENSIONS, INTERNAL:

Cockpit: Length	2.15 m (7 ft 0 3/4 in)
Max width	0.70 m (2 ft 3 1/2 in)
Max height	1.10 m (3 ft 7 1/4 in)

AREAS:

Wings, gross	15.40 m ² (165.8 sq ft)
Ailerons (total)	1.54 m ² (16.58 sq ft)
Flaps (total)	2.72 m ² (29.28 sq ft)
Fin	0.97 m ² (10.44 sq ft)
Rudder	0.73 m ² (7.86 sq ft)
Tailplane	2.88 m ² (31.00 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	450 kg (992 lb)
Max T-O weight	750 kg (1,653 lb)
Wing loading	47.8 kg/m ² (9.79 lb/sq ft)
Power loading	5.10 kg/kW (8.38 lb/hp)

PERFORMANCE:

Never-exceed speed (VNE)	156 kt (290 km/h; 180 mph)
Max level speed	140 kt (260 km/h; 162 mph)
Cruising speed at 75% power	119 kt (220 km/h; 137 mph)
Econ cruising speed	97 kt (180 km/h; 112 mph)
Stalling speed: flaps up	46 kt (85 km/h; 53 mph)
flaps down	37 kt (67 km/h; 42 mph)
Max rate of climb at S/L	660 m (2,165 ft)/min
Rate of climb at S/L, OEI	240 m (787 ft)/min
Service ceiling	8,535 m (28,000 ft)
Service ceiling, OEI	4,500 m (14,760 ft)
T-O run	120 m (395 ft)
T-O to 15 m (50 ft)	200 m (660 ft)
Landing from 15 m (50 ft)	300 m (985 ft)
Landing run	150 m (495 ft)
Range, 30 min reserves	513 n miles (950 km; 590 miles)
Endurance	6 h
g limits	+4.4/-1.76

ANTONOV

NATSIONAL'NAYA KORPORATSIA SAMOLET-ZDANI
ANTONOVA
(ANTONOV NATIONAL AIRCRAFT-BUILDING CORPORATION)

GENERAL DIRECTOR: Anatoly Myalitsa

On 14 July 2005, Ukrainian parliament approved plans for creation of 'National Amalgamation Antonov' which to encompass Antonov design bureau; formerly separate aircraft building plants at Kiev and Kharkov; and No 410 Civil Aviation Depot at Kiev. New grouping to employ 20,000 workers and be augmented at later stage by UkrNIIAT (state scientific research institute for aviation technologies).

By mid-2006, Antonov Corporation was controlling central revenues, although existing contracts were still being fulfilled by individual companies, and few steps taken towards formulation of unified strategy and funding plan.

AVIATSIONNY NAUCHNO-TEKHNICHESKY KOMPLEKS imeni O K ANTONOVA
(Aviation Scientific-Technical Complex named for O K Antonov)

ulitsa Tupoleva 1, 03062 Kiev

Tel: (+38 044) 454 31 49 and 442 60 75

Fax: (+38 044) 442 41 44

e-mail: info@antonov.com

Web: www.antonov.com



Antonov An-32s being completed for Libya from stock airframes held by Aviant

1158190

GENERAL DESIGNER: Dmytro S Kiva

FIRST DUPT GENERAL DESIGNER: Volodymyr Shmiryov

EXECUTIVE DIRECTOR, ANTONOV AIRLINES: Konstantin F Lushakov

HEAD OF MARKETING AND SALES: Alexander Kiva

PUBLIC RELATIONS OFFICER: Andrey Sovenko

Antonov OKB was founded by a decree of 31 May 1946, existing initially at Novosibirsk as OKB 153, under Oleg Konstantinovich Antonov, who died 4 April 1984, aged 78. Initial design was SKh-1, better known as An-2; design bureau re-established at Kiev in mid-1952. More than 22,000 aircraft of over 100 types and versions of Antonov design have been built; more than 1,500 have been exported, to 72 countries. Other production includes trolley-buses, trams and racing bicycles.

Antonov continues to be engaged in designing and building new aircraft prototypes as well as modifications of earlier designs; and the provision of operational and product support and engineering work on extending the service life of existing aircraft. It also provides service such as basic and conversion training for flight and maintenance crews; and international air charter transportation, particularly of outsize cargoes. On-site training of personnel is available. Antonov also participates in international co-operation in the field of aircraft and equipment design and manufacture as well as the development of land vehicles.

Current projects include the An-148 twin-turboprop airliner and An-70 military transport. On 29 October 2004 agreement reached with PZL of Poland on joint development of An-128 variant of An-28 which to be marketed as replacement for M28 Skytruck.

Antonov received Aviation Register approval on 30 December 1992 to develop civil aircraft. It also operates its own cargo airline with a fleet of one An-225, seven An-124s, one An-22, three An-12s, and one each An-26 and An-74. Company parents the Medium Transport Aircraft International Consortium created by Russia and Ukraine in February 1996 and formally established on 18 May 1999.

By November 2003, Antonov-designed aircraft held 477 international records, including 124 gained by the An-225 in a single sortie on 1 September 2001.

Flight test airfield is Gostomel; works airfield at Svyatoshino in Kiev suburbs. Established freight division in 1989, this becoming Antonov Airlines with fleet of seven An-124s, single An-225 and six other Antonov types available for commercial leasing.

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COMMERCIAL DIRECTOR: Oleksandr Grybanov

TRADE DEPARTMENT DIRECTOR: Valery Kuzenkov

The Kiev Aviation Plant has effectively terminated work on the Antonov An-32 twin-turboprop transport and An-124 heavy transport, the 19th and last Kiev-built An-124 having flown on 6 October 2003. However, it built two prototypes of the An-70 four-propfan transport and shares in production with Aviacor at Samara. The two firms will also manufacture the Tupolev Tu-334 twin-turboprop transport of which initial Aviant aircraft first flew

21 November 2003. Budgetary financing for two An-70s received December 2005. Overhauls An-24/26, An-32 and An-124 aircraft. Offers An-3 turboprop conversion of Antonov An-2 as parallel to Polyot conversion in Russia. By early 2006 had orders for seven An-148s, of which first batch of five then in hand, including two for Kazakhstan. Non-aviation activities include manufacture of trolley-buses, pressure chambers and customer goods. Recently contributed to manufacture of prototype Aviaimpex Yanhol helicopter prototype and is involved in manufacture of Aeros flex-wing trikes.

Aviant previously built 3,320 An-2s (1947–59), An-8s (1956–59), 1,028 An-24s (1959–78), 1,402 An-26s (1969–85), 123 An-30s (1973–79), 361 An-32s and 18 An-124s. Will participate in planned continuation of An-124 production. An-32 remains available to order, using stock of 15 uncompleted fuselages. Two An-32Ps for Libya delivered January 2006, together with further two second-hand examples for same customer from Antonov bureau, increasing production to 363. Five An-32s reportedly under construction for UAE in 2006. Further interest from Mexico, Sri Lanka and Turkey yet to have firm results.

KHARKOVSKOYE GOSUDARSTVENNOYE AVIATIONNOYE PROIZVODSTVENNOYE PREDPRIYATIE (Kharkov State Aviation Production Enterprise)

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HEAD OF INFORMATION BUREAU: Andrey Ignatyev

Established in 1926 as GAZ 135, Kharkov State Aircraft Manufacturing Company (KSAMC) has built military, passenger and freight aircraft, including the K-5, KhAI-1, K-7, Su-2, MiG-15UT1, Tu-104, Tu-124, Tu-134 and An-72/72P, plus Tu-141 UAV. Export of its products began in 1964. ISO 9002 was gained in 1998.

Current production is centred on the 52-seat Antonov An-140-100 twin-turboprop and Antonov An-74 in various versions, including the An-74TK-300, with underslung engine. Flew An-74T-200A subvariant on 24 December 2004, this being first of five for Egypt, plus two An-74TK-200S 'flying hospitals' for Syria. Also produces centre wing section for Antonov An-148 production by Aviant.

Kharkov consortium also provides support services, including maintenance, flying training, technical training, spare parts provision, ground equipment, test equipment and turnkey maintenance facilities.

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Established in 1948, GAZ 410 (Westernised as ARP 410) is licensed to overhaul, maintain and modify the full range of Antonov-designed aircraft, as well as their engines and systems.

ANTONOV An-38

TYPE: Twin-turboprop transport.

PROGRAMME: Requirement for 25–30 seat development of An-28 emerged during 1989 sales tour of India. Development of all-new An-38 approved by Soviet Ministry of Aviation, late 1990. Details announced, and model displayed, at 1991 Paris Air Show: initial batch of six built, not by Antonov, but at production factory, NAPO, Novosibirsk, Russia: one prototype (01001; first flight 23 June 1994, with TPE331 engines), four trials aircraft and one (01002) for static testing at Kiev; certification to AP-25 granted 22 April 1997. In December 1995, Antonov and NAPO formed joint venture company, Siberian Antonov Aircraft, to produce, market and provide after-sales service for the An-38. Indian demonstration tour undertaken in July and August 1997, followed by appearance at Aero India in December 1998 and February 2001.

Production at NAPO was suspended between 2000 and 2003, but in March 2003 an agreement was signed by the plant, Moscow Leasing Company and Volgograd-SpetzAvia for resumption with a batch of five. In January 2006, NAPO in discussions with VulcanAir of Italy, latter offering to finance EASA certification in return for appointment as completion centre for estimated 60 An-38s required in Europe.

CURRENT VERSIONS: **An-38-100:** With Honeywell TPE331 engines. First and second (01003; exhibited Moscow 1997) flying aircraft to this standard. Trials of international navigation avionics completed March 2000.

An-38-110: Reduced avionics fit in comparison with -100.

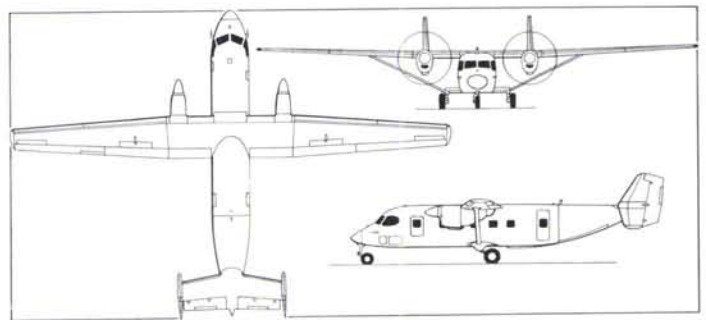
An-38-120: Enhanced avionics fit in comparison with -100; equipment includes VOR/DME, Opal-B voice recorder and SPPZ-2000 ground proximity warner. At least RA-41900 and 41902 to this standard.

An-38-200: With Omsk MKB 'Mars' TVD-20-03 engines. Third and fourth prototypes were planned to this standard when engine development complete; however, minor problems with Aerosila AV-36M propeller delayed programme, but maiden flight achieved (at NAPO) 11 December 2001. Equipment standard as for An-38-120, but with addition of TCAS-2000 traffic collision avoidance system. State Tests were completed on 28 November 2002. Subsequent report indicated "no significant advantages" over TPE331 version.

An-38D: Proposed military version for parachutist dropping, medical evacuation and general light transport.

An-38K: Convertible version of An-38-100; large upward-hinging side door at rear on port side; able to carry four LD-3 (KMP-500) or five LD-3K containers (= konteynery); cargo handling equipment removable for conversion to 30-passenger transport.

Versions with RKBK TVD-1500 engines said to be under construction in 2000, but none had emerged by mid-2002. All versions can be equipped for aerial photography (An-38F;



Antonov An-38-100 27-seat transport (Mike Keep)

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fotografiya), survey (An-38GF *geofizicheskyy*), forest patrol (An-38D: *desantnyi*), VIP transport, ambulance (An-38S: *sanitarnyy*; six stretchers, nine seated, with attendant) and fishery/ice patrol duties (An-38LR: *ledovoi razvedki*). An assault transport, also designated An-38D, capable of carrying 22 paratroops, 26 troops or 3 tonnes of cargo, was revealed to be in the design stage in August 2001; -100 or -200 engine options will be available.

CUSTOMERS: Eight Srs 100s produced by mid-2000: two prototypes (one at Antonov; one at NAPO), one static test airframe and five with airlines (Vostok, three; Alrosa, two); by mid-2004, no further production had been undertaken, and, in fact, only four production aircraft positively identified. Further four reported under construction in 2005 for delivery from October that year, including one for Khromaton of Moscow for remote earth sensing. Two Vostok aircraft to Malaysia during 2001 for lease by Layang Layang Aerospace for tourist flights, cargo transport and aerial photography.

First three (subsequently increased to eight) An-38-100s ordered for Vostok Airlines and received by mid-1995 for one year of intensive trials before passenger certification. Second firm customer is Chukotavia (10; although initial batch is two); letters of intent from Petropavlovsk-Kamchatsky, Merninsky, Novosibirsky, Ulyanovsk and Nikolaevsk-na-Amur. In 1999–2000, second prototype was being operated by NAPO-Aviatrans, the airline of the NAPO aircraft factory; this also to Layang Layang by 2003. By July 2003, Layang Layang was discussing order for six An-38s subsequent to type's certification in Malaya. In 1998, Siberia Airlines was considering purchase of two. Alrosa-Avia of Zhukovsky has ordered five for diamond mining support, of which first in service by early 2000; second followed in July 2000. Indian Air Force interest expressed in initial six to 10; estimated market for 40 with Indian regional airlines (2001), of which 20 covered by letters of intent. Interest in -200 from Vietnam Airlines, which in 2001 signed lease for NAPO's own -120; this still in Vietnam in 2004 with a second Vostok aircraft. On conclusion of lease, two Vietnamese aircraft transferred to Hangard Airlines of Mongolia in mid-2005. First customer for Srs 200 was expected to have been Kemerovo Airlines, which required two for delivery in late 2003.

ANTONOV An-38 KNOWN PRODUCTION

Registration	Remarks
3810001	Prototype
3810002	Static test airframe
3810003	Second prototype
RA-41900	NAPO-Aviatrans; Layang Layang 2003; Vietnam Air Services 2004-05; Hangard Airlines 2005
RA-41901	Vostok; Layang Layang 2002; Vostok 2004-05; Hangard Airlines 2005
RA-41902	Vostok; Vietnam Air Services 2004
RA-41903	Vostok; Layang Layang as 9M-LLB

Notes: 3810003 and RA-41900 may be the same aircraft. An-38-200 prototype reported as RA-41910.

COSTS: An-38-100 basic price USD4 million (2000); An-38-200 USD3.5 million (2003).

DESIGN FEATURES: Developed from PZL Mielec (Antonov) An-28 to replace An-24s, Let L 410s and Yak-40s. New high-efficiency engines; lengthened passenger cabin; optional weather radar and automatic flight control system; improved sound and vibration insulation; reduced external noise; wheel or ski landing gear; rear cargo door and cargo handling system; able to operate from unpaved runways; operating temperatures from -45 to +45°C, including 'hot-and-high' conditions. Service life 30,000 hours. Maintenance (including overhaul) requirement 4 man-hours/flying hour.

FLYING CONTROLS: Conventional and manual. Single-slotted mass and aerodynamically balanced ailerons (port aileron has trim tab), designed to droop with large, hydraulically actuated, two-segment double-slotted flaps; electrically actuated trim tabs in each elevator have manual back-up; twin rudders each with electrically actuated trim tab; automatic leading-edge slats over full span of wing outboard of engines; slab-type spoiler forward of each aileron and each outer flap segment at 75 per cent chord.

LANDING GEAR: Tricycle type; fixed. Mainwheels 610x320-330; nosewheel 600x320-254.

POWER PLANT: Two Honeywell TPE331-14GR-801E turboprops, each 1,118 kW (1,500 shp), driving Hartzell HC-B5MA five-blade propellers rotating at 1,522 rpm; or two Omsk MKB 'Mars' TVD-20 turboprops, each 1,029 kW (1,380 shp), driving Aerosila AV-36M quiet, constant-speed reversible-pitch propellers rotating at 1,827 rpm.

ACCOMMODATION: Two crew side by side on flight deck; passenger cabin equipped normally with 26 seats, basically three-abreast, with centre aisle; 27 seats at 75 cm (29½ in) pitch optional; ambulance version for six stretchers, eight seated casualties and medical attendant, executive versions with eight to 10 seats and forest surveillance/paratroop version for 26 smoke-jumpers or trainee paratroops (reduced to 22 with full kit) available; seats and baggage compartment can be folded quickly against cabin wall to provide clear space for 2,500 kg (5,510 lb) of freight. Maximum practical cargo dimensions in combi variant are 1.40 m (4 ft 7 in) height and 1.05 m (3 ft 5½ in) width with seats removed or 0.95 m (3 ft 1½ in) with seats stowed against walls. Door with airstairs on port side, with service door opposite; emergency exit each side. Optional cargo door under upswept rear fuselage slides forward under cabin for direct loading/unloading of freight.

AVIONICS: Russian or Western equipment; latter comprises Bendix/King Silver Crown range; former listed below.

Comms: SO-72 transponder.

Radar: A813Ts weather radar.

Flight: BSFK-1 navigation system; VEM-72PB-3A altimeter and A-037 radar altimeter; twin US-450K airspeed indicators; SAU-28 AFCS; M3 GPS; VMD-94 DME; SPPZ-200 GPWS; TCAS-2000 TCAS; and KURS-93M autoland.

EQUIPMENT: Hand-operated travelling overhead winch in cabin; capacity 500 kg (1,102 lb).



Antonov An-38-120 of Vietnam Air Services

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DIMENSIONS, EXTERNAL:

Wing span	22.065 m (72 ft 4¾ in)
Length overall	15.67 m (51 ft 5 in)
Height overall	5.05 m (16 ft 6¾ in)
Span over tailfins	5.14 m (16 ft 10½ in)
Wheel track	3.515 m (11 ft 6½ in)
Wheelbase	6.345 m (20 ft 9¾ in)
Distance between propeller centres	5.58 m (18 ft 3¾ in)
Propeller diameter: Hartzell	2.85 m (9 ft 4 in)
AV-36	2.65 m (8 ft 8¾ in)
Cargo ramp:	
Length	2.40 m (7 ft 10½ in)
Width: at floor	1.40 m (4 ft 7 in)
at rear	1.00 m (3 ft 3¼ in)
Passenger door: Width	0.70 m (2 ft 3½ in)
Height	1.55 m (5 ft 1 in)

DIMENSIONS, INTERNAL:

Cargo hold: Length, excl ramp	7.83 m (25 ft 8¼ in)
Width: max	1.74 m (5 ft 8½ in)
at floor	1.55 m (5 ft 1 in)
Max height	1.70 m (5 ft 7 in)
Volume, incl ramp	24.7 m³ (872 cu ft)

WEIGHTS AND LOADINGS (A: An-38-100, B: An-38-200, K: An-38K):

Weight empty: A	5,735 kg (12,643 lb)
Max payload: A, B	2,500 kg (5,510 lb)
K	3,200 kg (7,055 lb)
Max fuel: A	2,210 kg (4,872 lb)
Max T-O weight: A	9,500 kg (20,943 lb)
B	9,930 kg (21,891 lb)

PERFORMANCE (estimated, with TPE331 engines):

Max level speed	219 kt (405 km/h; 252 mph)
Nominal cruising speed:	
A, B	205 kt (380 km/h; 236 mph)
Nominal max cruising altitude: A, B	4,200 m (13,780 ft)
T-O run: A	350 m (1,150 ft)
K	480 m (1,575 ft)
Landing run: A	270 m (885 ft)
K	440 m (1,445 ft)
Balanced field length: A	895 m (2,940 ft)
B	1,050 m (3,445 ft)
Range at FL100, no reserves:	
with max payload: A	513 n miles (950 km; 590 miles)
B	540 n miles (1,000 km; 621 miles)
with max fuel (1,650 kg; 3,638 lb payload):	
A	944 n miles (1,750 km; 1,087 miles)
B	961 n miles (1,780 km; 1,106 miles)

ANTONOV An-70

TYPE: Medium transport/multirole,
PROGRAMME:

DEVELOPMENT MILESTONES

Design began	1986
Announced	20 Dec 88
Official go-ahead	24 Jun 93
Rolled out	20 Jan 94
First flight	16 Dec 94
Production go-ahead	12 Oct 00

Development began 1986 to replace some An-12s remaining in air force service from 2002–2003; initial all-metal, 5.0 m (16 ft 5 in) fuselage diameter design featured four D-236 turboprops and tail gunner's position, and was in competition with Yakovlev design (then known as Yak-44). Significant redesign began in 1986, upon appointment of Pyotr Balabuev as designer, resulting in postponement of planned 1986 first flight.

Announced by *Izvestia* 20 December 1988; at 1991 Paris Air Show Antonov OKB reported prototype being assembled at Kiev; funding by Russian (80 per cent) and Ukrainian governments under agreement of 24 June 1993; preliminary details released and model displayed at Moscow Aero Engine and Industry Show April 1992.

Prototype rolled out at Antonov's Kiev plant on 20 January 1994; first flight (01-01) 16 December 1994 (was also delivery flight to Gostomel test airfield); this aircraft lost during fourth sortie following in-flight collision with chase An-72 on 10 February 1995. Second prototype produced by upgrading of static test airframe (for which replacement under construction in 2000); rolled out 24 December 1996; first flight (01-02/UR-NTK) 24 April 1997; international debut at Moscow Air Show, August 1997; handed over to Russian Air Forces' test centre at Akhtubinsk, August 1998. Had flown 380 of planned 780-sortie test programme by January 2001; high AoA trials mid-2000; first stage of State testing completed October 2000, confirming safety in all flight regimes. Crash-landed and fuselage broken into two parts immediately after take-off from Omsk on 27 January 2001 following double engine failure. Airframe transferred to Polet aircraft plant and repaired at cost of

US\$3 million; reflown 5 June 2001; certification rescheduled to first quarter of 2002; appeared at MAKS '01, Moscow, August 2001. By June 2004, stated to require further 100 sorties to complete testing, which target set for end of 2005. Trials delayed because of "deficiencies in D-27 engine"; Russian Air Forces' C-in-C stated in December 2004 that these now "eliminated" and testing to resume.

Bilateral agreement between Russia and Ukraine revised 18 May 1999, and underlined decision taken to order first 10 (and 50 engines) before planned production at Aviant plant, Kiev, from 1999 and Aviacor plant, Samara, from 2000; each plant building initial batch of five, which then intended to enter service by 2003. Russian production specification issued 4 December 1999; Russian government decree of 4 October 2000 covers purchase of 164 An-70s, but, at same time, Samara regional government announced that local manufacturers were withdrawing from An-70 project. In late 2003, power-plant manufacturing partner, Salyut of Moscow, proposed a revised compressor design for D-27 engine which would address Russian military concern over efficiency and reliability. Other sources reported simultaneously that these issues already solved in Ukraine. Ukrainian government resolution guaranteeing An-70 purchase passed 12 October 2000; total of 65 to be obtained by 2018. First five for Ukraine ordered from Aviant on 2 April 2001. However, in September 2001, Polyot was allocated Russian An-70 final assembly, augmented by Novosibirsk's NAPO and Voronezh's VASO. Aviacor no longer involved. Russian share of series production is 72 per cent; Ukraine 28 per cent. Assembly of first Polet-built An-70 formally began on 10 October 2002. Polet (Russian) and Aviant plants signed agreement in June 2004 for joint manufacture of An-70 in Ukraine using Russian-built components.

By September 2002, An-70 had flown 550 hours in 440 sorties towards anticipated late 2003 completion of State Tests, but unofficial reports were by that time citing alleged discovery of 382 deficiencies, of which 95 rated essential for pre-delivery rectification. These included engine reliability, the prototype having suffered 52 in-flight shutdowns during its 440 sorties. Russian Air Forces' disinclination to fund An-70 was being discussed in November 2002, and C-in-C voiced outright rejection of purchase at January 2003 press conference, claiming An-70 unsuitable for its intended task of replacing An-12, and pledging support for rival Tupolev Tu-330. Joint (Russo-Ukrainian) acceptance testing was frozen on 25 February 2003; resumed following signature of agreement by Cs-in-C of Russian and Ukrainian air forces, 16 June 2004. By April 2003 however, it was reported unofficially that Air Forces' support had been resumed, but with proviso of rewritten TTZ (tactical and technical specification) detailing changes to avionics and equipment and extending development period. Optimism short-lived, and despite support from some political quarters, An-70 funding was removed from 2004 budget at military request.

Faced with shortfall in Russian financial support, Ukrainian government considered unilateral financial support in 2003 national budget, allowing production launch, but decided against the proposal in November 2002, although continued flight testing did receive official funds. Trials at Feodosia test centre included February 2003 air-drop within 18 seconds of four pallets totalling 34.5 tonnes; operations planned from airstrips with bearing strength of between 6 and 9 kgf/cm² (85 to 128 lbf/sq in). Short field trials at Feodosia between 18 July and 4 August 2003.

Ukrainian parliament decision of February 2004 to complete An-70 development and production in two-stage programme between 2004 and 2022 assigns some Hr1 billion up to 2006 for development (Hr130 million; USD25 million), production investment (Hr450 million; USD85 million) and two production aircraft (Hr430 million; USD80 million). Initial expenditure in 2004 was Hr243 million (USD46 million). Phase 2, from 2007 to 2022, not yet costed; these two received funding in December 2005 to permit manufacturing launch by Aviant production plant.

In late 2005/early 2006, Russian and Ukrainian media reported numerous statements and counter-statements concerning Russian Air Forces' intentions towards An-70, it appearing that senior military commanders considered purchase unnecessary. Stage 'B' of State Tests begun April 2006 after An-70 demonstrated improved gas dynamic stability of modified engines during four test sorties.

Medium Transport Aircraft International Consortium (MTA) formed February 1996 to co-ordinate development, certification, sales and after-service, comprising four Ukrainian and six Russian companies: ANTK Antonov (designer and component manufacturer), ZMKB Progress (engine designer), Aviant (airframe manufacturer) and Motor Sich (engine manufacturer) from Ukraine; Aviapribor (flight control system manufacturer), Elektroavtomatika (avionics), Leninet (airborne monitoring and diagnostic system) and Aerosila (propfan) from Russia. Refer to 'Structure'. Following inconclusive discussions with Russia over international promotion, Ukraine unilaterally announced Poland as partner for Western sales of An-70 in November 2003. Was also hoping to obtain Chinese order. MTA consortium reported in late 2004 to be in process of liquidation.

CURRENT VERSIONS: **An-70:** Military STOL transport; proposed production version. Stated to have double the payload of Lockheed Martin C-130J, with similar STOL and rough-field performance, yet only 40 kt (74 km/h; 46 mph) slower than the Boeing C-17A Globemaster III, which carries 15 per cent more payload.

Detailed description applies to baseline An-70.

An-70-100: Civilian transport. Reported in 2005 to have received expressions of interest from UAE and Ukrainian air transport companies. Aviant predicts break-even at 20; unit cost USD50 million. Production could begin in 2008. Noise compliance certificate issued to An-70 on 22 December 2005 confirming Level 3, Appendix C, ICAO Part 36.

An-77: Proposed military STOL transport for export customers; as An-70-100 but with cockpit for two or three crew. Runway length of 1,900 m (6,235 ft) required with 35,000 kg (77,161 lb) payload for 2,051 n mile (3,800 km; 2,361 mile) range.



Antonov An-70 tactical transport (Yefim Gordon)

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An-70T: Commercial transport, generally as An-70, with improved runway capability but no requirement for STOL. Two or three crew. To carry 35,000 kg (77,161 lb) payload 2,051 n miles (3,800 km; 2,361 miles) from 1,900 m (6,235 ft) runway, or 20,000 kg (44,092 lb) for 2,915 n miles (5,400 km; 3,555 miles) from 1,300 m (4,265 ft) runway.

An-170: Heavy transport derivative carrying 45,000–50,000 kg (99,210–110,230 lb) of cargo.

CUSTOMERS: Requirements originally expressed by Russian Air Forces for up to 500 and by Ukrainian Air Force for 100. This modified by 1999 to 164 for Russia and 65 for Ukraine, with envisaged in-service date of 2002. German requirement potentially for 75 aircraft. By mid-1999 potential civil operators had signed documents of intent for some 100 further aircraft. Chinese interest reported in 2000. Czech Republic reportedly finalising a contract for three in 2002, delivery to be from Omsk at one per year, beginning 2005. Not achieved, but Antonov statement of 2006 noted unequivocal Czech "order" for three.

COSTS: Military version USD60 million (2002), but estimated in 2003 that this could be reduced to "under USD40 million". Civil An-70T to cost 20 to 30 per cent less than military variant. Total of USD3,500 million reportedly spent on development by late 2002, of which Russian defence ministry then owed Antonov USD49 million; further USD86 million (of which USD61 million due from Russia) required to complete development and flight testing. Engines cost USD75 million up to 2002, and further USD30 million allegedly required to address recorded malfunctions during testing. Establishment of Russian assembly line at Polyot plant (Omsk) estimated to cost Rb3bn (2004).

DESIGN FEATURES: First aircraft to fly powered only by propfans. Slightly larger than projected European FLA transport, much smaller than US Boeing C-17A; conventional high-wing configuration, with wings and tail surfaces slightly sweptback; supercritical wing section; anhedral from roots; loading ramp/doors under upswept rear fuselage with adjustable sill height and built-in cargo handling system; horizontal tail surfaces on rear fuselage; propfans mounted conventionally on wing leading-edge; propeller wash doubles wing lift during take-off and landing. Multiple-section control surfaces provide redundancy in event of battle damage or physical obstruction. Claimed features include independent operational capability at non-equipped airfields for 30 days. Design life 15,000 cycles and 45,000 flying hours in 25 years. Operable 3,500 hours per year, with eight to 10 man-hours of maintenance per flying hour. Cost-effective with only 200 flying hours per month.

FLYING CONTROLS: Prototypes have fly-by-wire system with four digital and six analogue channels; primary controls are quadruplex; back-up by unique fly-by-hydraulics system, in which pilot or autopilot inputs are relayed (via conventional 'mini-wheels') to actuators by commands in hydraulic control channels, unaffected by electromagnetic interference. Production aircraft will have a four-channel, all-digital primary FCS, rather than the hybrid digital/analogue system of the prototypes. Secondary FCS controls two independent flap systems, leading-edge slats and blown flaps. Three-section double-winged rudder. Double-slotted trailing-edge blown Fowler flaps in two sections on each wing; forward element maximum deflection 60°; intermediate settings 5, 10, 15, 20, 25, 30, 35, 40 and 50°. Three-section spoilers forward of each outer flap. Leading-edge has flaps inboard; slats centre and outboard. Two-section, double-hinged elevators forward section maximum deflections +28/–20°, rear section +50/–40°, to enhance low-speed authority; horizontal stabilisers are fitted with automatic leading-edge slats.

STRUCTURE: Approximately 28 per cent of airframe, by weight, made of Organit composites, including complete tail unit, ailerons and flaps. Fuselage stringer/skin joints are spot-welded and hot-bonded, manually.

Single source for all major components. Russian assembly by Polyot, which also to build cargo hold; NAPO producing the centre section; VASO, the wing. Aviant at Kiev to assemble Ukrainian aircraft and build flight deck, empennage and engine nacelles.

LANDING GEAR: Twin-wheel nose unit; each main unit has three pairs of wheels in tandem, retracting into large fairing on side of cabin; can operate from CBR6 unpaved surfaces. All tyres 1,120x450. Steel-steel brakes. Nosewheel turning angle ±55° for taxiing; nosewheel turning radius 19.6 m (64¼ ft); wingtip turning radius 34.8 m (114¼ ft); required taxiway width for 180° turn 38.4 m (126 ft).

POWER PLANT: Four ZMKB Progress/Ivchenko D-27 propfans, each 10,290 kW (13,800 shp) built consortium including Motor-Sich and Russia's Salyut. Aerosyla Stupino SV-27 contrarotating propellers, each with eight composites blades in front and six at rear. Reversible-pitch blades of scimitar form, with electric anti-icing.

ACCOMMODATION: Three flight crew (two pilots and flight engineer or 'tactical pilot') plus loadmaster; navigation station on captain's left is optionally operated by fourth member of flight crew; provision for converting cockpit for two-crew operation, with co-pilot operating flight engineer's station; seats in forward fuselage for two cargo attendants; freight loaded via rear ramp using four built-in, powered hoists (each of 3 tonne capacity) reaching out 6.6 m (22 ft) from aircraft. Hoists can be combined for heavier loads. Freight can be carried on PA-5.6 rigid pallets, PA-3, PA-4 and PA-6.8 flexible pallets, in UAK-2.5, UAK-5 and UAK-10 containers; unpackaged freight, wheeled and tracked vehicles, food and perishables can be carried; seats for 300 troops, or 206 stretchers, can be installed using optional, prefabricated (10 section) upper deck or optional, easily removable seven-section upper deck in cargo hold; vehicles, freight and paratroops can be airdropped; maximum

single airdrop item weight 20,000 kg (44,092 lb); crew door at front of cabin on port side; two upper deck doors each side, front and rear; cargo hold pressurised and air conditioned. **SYSTEMS:** Aircraft systems automated to simplify operation and decrease probability of crew errors. Electronpribor engine control system; Leninet's monitoring and information system. **AVIONICS:** Integrated by Aviapribor, Leninet's and Elektroavtomatika. Flight data, navigation and radio-navigation systems to ARINC 700 requirements; digital multiplex data interface equivalent to Western MIL-STD-1553B.

Comms: Integrated system by Gorkiski.

Flight: Ring laser INS; SKI-77 HUD; flight management system; designed for operation in adverse weather and for landing in ICAO Cat. II and IIIa conditions. BASK-70 onboard diagnostic system collects data from subsystems, registering and analysing about 8,000 parameters.

Instrumentation: Ten-screen EFIS by Elektroavtomatika comprises six main screens, each 200 × 200 mm (7¾ × 7¾ in), facing pilots and two each at navigation and flight engineer's stations, plus smaller secondary LCD screens and roof-mounted HUDs for pilot and co-pilot on production aircraft.

EQUIPMENT: Four electric hoists in hold.

DIMENSIONS, EXTERNAL:

Wing span	44.06 m (144 ft 6¾ in)
Length overall	40.73 m (133 ft 7½ in)
Fuselage diameter	5.60 m (18 ft 4½ in)
Height overall	16.38 m (53 ft 9 in)
Wheel track (bogie centres)	5.21 m (17 ft 1 in)
Wheelbase: front mainwheels	12.48 m (40 ft 11¼ in)
centre mainwheels	13.98 m (45 ft 10½ in)
rear mainwheels	15.48 m (50 ft 9¾ in)
Propeller diameter	4.50 m (14 ft 9 in)
Propeller ground clearance (outer)	3.00 m (9 ft 10 in)
Rear-loading aperture: Height	4.10 m (13 ft 5½ in)
Width	4.00 m (13 ft 1½ in)

DIMENSIONS, INTERNAL:

Cargo hold:	
Floor length: excl ramp	18.60 m (61 ft 0¼ in)
incl loadable ramp	21.90 m (71 ft 10¼ in)
Max width	4.80 m (15 ft 9 in)
Max width at floor	4.00 m (13 ft 1½ in)
Height: max	4.40 m (14 ft 5¼ in)
min	4.10 m (13 ft 5½ in)
Floor area, incl ramp	89.0 m² (958 sq ft)
Volume: pressurised	400.0 m³ (14,126 cu ft)
total	425.0 m³ (15,008 cu ft)

WEIGHTS AND LOADINGS:

Weight empty	74,000 kg (163,140 lb)
Normal payload (incl 5,000 kg; 11,025 lb on ramp)	35,000 kg (77,161 lb)
Normal payload from unpaved runway	30,000 kg (66,138 lb)
Payload: max	47,000 kg (103,615 lb)
restricted runway option	35,000 kg (77,161 lb)
700 m runway option	20,000 kg (44,092 lb)
Max T-O weight	145,000 kg (319,675 lb)
Max power loading	3.52 kg/kW (5.79 lb/shp)

PERFORMANCE (estimated):

Cruising speed: long range	405 kt (750 km/h; 466 mph)
max short range	432 kt (800 km/h; 497 mph)
Min control speed (demonstrated)	53 kt (98 km/h; 61 mph)
Nominal cruising height	9,100–11,000 m (29,860–36,080 ft)
Runway length required:	
conventional T-O	1,550–1,800 m (5,085–5,905 ft)
short T-O	700 m (2,300 ft)
Range (runway length A: 1,800 m; 5,905 ft, B: 700 m; 2,300 ft):	
with 47 tonnes: A	1,619 n miles (3,000 km; 1,864 miles)
B	not an option
with 35 tonnes: A	2,699 n miles (5,000 km; 3,106 miles)
B	not an option
with 30 tonnes: A	3,239 n miles (6,000 km; 3,728 miles)
B	647 n miles (1,200 km; 745 miles)
with 20 tonnes: A	3,563 n miles (6,600 km; 4,101 miles)
B	1,619 n miles (3,000 km; 1,864 miles)
with max fuel: all options	4,319 n miles (8,000 km; 4,971 miles)

ANTONOV An-72 and An-74

NATO reporting name: Coaler

TYPE: Twin-jet freighter.

PROGRAMME: Originated as military transport based on stillborn An-60 64–73 seat civil airliner designed to meet 1967 specification. Revised design, following issue of military requirement in 1968, included relocation of engines above wings. Prototype An-72, built at Kiev, flew (SSSR-19774) 31 August 1977, followed by five (one static test, one fatigue test, three flying) preproduction aircraft, 1979–81. Manufacture transferred to Kharkov, Ukraine, where first production An-72 flew 22 December 1985.

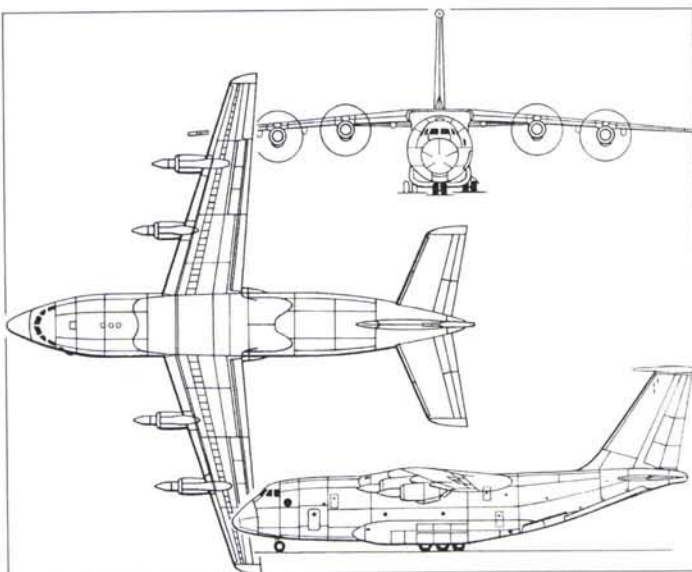
An-74 also produced at Kharkov from December 1986. An-74 announced February 1984, meeting requirement for operation in Arctic and Antarctic conditions. An-72P maritime patrol version demonstrated 1992. Production of An-74 also started by Polyot Industrial Association at Omsk, Russia, in 1993 (assisted by Progress at Arsenyev); first Polyot aircraft (RA-74050) was flown 25 December 1993. Development by Antonov of various new versions of An-74 started 1995.

CURRENT VERSIONS: **An-72A: ('Coaler-C')** STOL transport for military use. Compared with An-72 ('Coaler-A') prototypes, wing span increased by 6.00 m (19 ft 8¼ in), fuselage length by 1.50 m (4 ft 11 in), fuel load by 2,500 kg (5,512 lb). An-72 prototype 003/SSSR-19795 converted to An-74 and first flew (SSSR-780334) 29 September 1983. Additionally, on production version, tail unit and engine air intake de-icing improved over An-72 prototype; Buran radar in enlarged radome; advanced navigation aids, including inertial navigation system; provision for wheel/ski landing gear.

An-72P: Maritime patrol version; delivered to Ukraine during 1990s.

An-72-100: Civilianised An-72, certified 1997; upgraded avionics.

An-74: Designation refers, generally, to all civilian versions (as under), although initially intended for Polar research, ice floe reconnaissance and transport. Airframe identical with An-72 except for two blister windows at rear of flight deck and front of cabin on port side. Proving trials 1983–89. First preproduction An-74 (SSSR-58642) first flew at Kharkov on 26 June 1986; further five development aircraft built by 1989. Maiden flight of production



Antonov An-70 tactical transport (James Goulding)

1158575



Antonov An-74TK-200 company demonstrator (Paul Jackson)

1158194

An-74 (c/n 0706) December 1989; features include new APU, Buran-74 radar in larger radome and improved navigation aids. Type certificate awarded August 1991; initially operated by Yakutsk division of Aeroflot.

An-74-200: Freight version with D-36 Series 3A engines of unchanged rating; increased payload and maximum T-O weight. Able to carry four UAK-2.5 containers. Crew of four/five.

An-74T-200A: ('Coaler-B') Transport (*transportnyi*) version with longer hold; payload 10,000 kg (22,045 lb); roller conveyors in floor. Improved navigation aids and digital ('semi-glass') flight deck with B-RNAV, RNP-5 and RNP-1, compatible with ICAO air traffic requirements up to 2015; two flight crew. Range with maximum payload up to 728 n miles (1,350 km; 838 miles), with 3,500 kg (7,716 lb) payload 2,159 n miles (4,000 km; 2,485 miles). MTOW increased to 36,500 kg (80,468 lb). First flight 28 April 2005; due for delivery to Egypt in late 2005.

An-74TK-200: ('Coaler-B') Convertible transport/passenger aircraft (*transportnyi konvertiruyemyyi*) with twin seats for 52 passengers that fold against cabin walls, and with baggage racks, buffet/galley and lavatory. Certified by Interstate Aviation Committee. Alternative all-cargo or all-passenger or combi layouts. Typical combi options include 12 passengers plus 6,000 kg (13,228 lb) of freight and 20 plus 4,500 kg (9,921 lb). Built-in loading equipment. Crew of two. Range with 10,000 kg (22,045 lb) payload, 1 hour reserve, 459 n miles (850 km; 528 miles).

An-74TK-200A: As TK-200, but with improved navigation aids and digital flight deck ensuring compliance with all ICAO requirements up to 2015. First flight (UR-CES) 24 December 2004. Deliveries to Egypt begun September 2005.

An-74TK-200S: 'Flying hospital' version of -200A. Two ordered by Syria for operation as civil aircraft by KS Avia.

An-74TK-100/200 Salon: Business transport for 10 to 16 passengers, with increased cabin comfort. Equipment includes telephone, fax, video, bar, refrigerator, galley and separate rest area. Optional compartment for car at rear. Power plant and weights as basic An-74. Crew of four/five. **An-74D** is similar.

An-74T-100: ('Coaler-B') As An-74T-200, with flight engineer and navigator stations (crew of four).

An-74TK-100: As An-74TK-200, with navigator and flight engineer stations (crew of four). Russian type certificate issued 4 August 1995.

An-74TK-100C: One VIP/medical evacuation aircraft (RA-74005) delivered to Gazprom on 26 February 2002. Air Ambulance Technology (Austrian) equipment. Designation remains '-100C' in both Cyrillic and Roman alphabets.

An-74TK-300: Described separately.

CUSTOMERS: More than 160 An-72/74s (including 96 military) built before An-74 production additionally established at Omsk; 20 in Russian Air Forces; four in Peruvian Air Force; 26 in Ukrainian Air Force; others in Estonia, Kazakhstan, Latvia, and Moldova. Total 'nearly 200' in service by 2005, with over 1 million hours flown, including 16,000 by fleet leader.

Order placed by Iran in 1997 for 12 An-74TKs for Presidential Guard; other recent deliveries to Laotian government, Ukraine Border Guard (one An-72P in 2002), MChS Rossii, Vitair and Gazpromavia. By end of 2003, operators included nine with 68 An-72s and eight with 62 An-74s. Two An-74TK-200s built at Kharkov in 1999–2000; about 180 built by 2003. Indian interest being pursued in 2000; Omsk received order for one for MChS Rossii and one of required three for Russian Federal Security Service, to have been delivered in 2003; by late 2003, Omsk had delivered total of only five aircraft since 1993 and had further two in various stages of completeness. Kharkov received orders from Egyptian and Libyan governments in July 2004 for three An-74TK-200As, all for Egypt, of which first (SU-BPM) handed over 16 September 2005; and An-74TK-200 and VIP version

for Libya, Egyptian order increased to nine. Sudan ordered five An-74s of various types on 25 December 2005; deliveries to begin March 2007 and continue at two-month intervals. COSTS: USD9 million (Omsk, 2000).

DESIGN FEATURES: Primary role as STOL replacement for turboprop An-26, with emphasis on freight carrying. High-wing, T-tail configuration, with upswept rear fuselage for freight access. Ejection of exhaust efflux over upper wing surface and down over large multislot flaps gives considerable increase in lift; high-set engines avoid foreign object ingestion; special ramp/door as An-26; low-pressure tyres and multiwheel landing gear for operation from unprepared strips, ice or snow; sweptback fin and rudder.

Wing leading-edge sweepback 17°; anhedral approximately 10° on outer wings; normal T-O flap setting 25 to 30°, maximum deflection 60°.

FLYING CONTROLS: Conventional and manual. Two tabs in port aileron, one starboard; double-hinged rudder, with tab in lower portion of two-section aft panel; during normal flight only lower rear rudder segment is used; both rear segments used in low-speed flight; forward segment is actuated automatically to offset thrust asymmetry; horn-balanced and mechanically actuated, aerodynamically balanced elevators, each with two tabs; hydraulically actuated full-span wing leading-edge flaps outboard of nacelles; trailing-edge flaps double-slotted in exhaust efflux, triple-slotted between nacelles and outer wings; four-section spoilers forward of triple-slotted flaps; two outer sections on each side raised before landing, remainder opened automatically on touchdown by sensors actuated by weight on main landing gear; inverted leading-edge slat on tailplane linked to wing flaps.

STRUCTURE: All-metal; multispar wings mounted above fuselage; wing skin, spoilers and flaps mainly of aluminium, but flaps covered with titanium aft of engine nacelles; circular semi-monocoque fuselage, with rear ramp/door; tapered fairing forward of T tail fin/tailplane junction, blending into oval rear fairing.

LANDING GEAR: Hydraulically retractable tricycle type, primarily of titanium. Rearward-retracting steerable twin-wheel nose unit. Each main unit comprises two trailing-arm legs in tandem, each with a single wheel, retracting inward through 90° so that wheels lie horizontally in bottom of fairings, outside fuselage pressure cell. Oleo-pneumatic shock-absorber in each unit. Low-pressure tyres, size 720x310 on nosewheels, 1,050x400 on mainwheels. Hydraulic disc brakes. Telescopic strut hinges downward, from rear of each side fairing, to support fuselage during direct loading of hold with ramp/door under fuselage.

POWER PLANT: Two ZMKB Progress/Ivchenko D-36 high-bypass ratio turboprops (Srs 2A in An-74; Srs 3A in An-74-200, T-100/200 and TK-100/200), each 63.74 kN (14,330 lb st). Integral fuel tanks between spars of outer wings. Thrust reversers standard.

ACCOMMODATION: An-72 has folding seats along sidewalls and removable central seats for 68 troops. Can carry 57 parachutists, and has provision for 24 stretcher patients. An-74's pilot and co-pilot/navigator side by side on flight deck, as in basic An-72, plus flight engineer, with provision for fourth person. Heated windshield with two wipers. Bulged observation windows on port side for navigator and hydrologist. Flight deck and cabin pressurised and air conditioned. Main cabin designed primarily for freight, including four UAK-2.5 containers or four PAV-2.5 pallets each weighing 2,500 kg (5,511 lb). Provision for wardrobe and galley. Movable bulkhead between passenger and freight compartments, with provision for 1,500 kg (3,307 lb) of freight in rear compartment. Reinforced, movable bulkhead in combi versions protects passengers from shifting cargo in the event of sudden deceleration. Main crew and passenger door at front of cabin on port side. Emergency exit and servicing door at rear of cabin on starboard side.

Downward-hinged and forward-sliding rear ramp/door for loading trucks and tracked vehicles, and for direct loading of hold from trucks. It is openable in flight, enabling freight loads of up to 7,500 kg (16,535 lb), with a maximum of 2,500 kg (5,511 lb) per individual item, to be airdropped by parachute extraction system. In normal freight role, 1,000 kg (2,204 lb) of payload can be placed on ramp. Maximum size of containers up to 1.90 x 2.44 x 1.46 m (6 ft 3 in x 8 ft x 4 ft 9 1/2 in), pallets up to 1.90 x 2.42 x 1.46 m (6 ft 3 in x 7 ft 11 in x 4 ft 9 1/2 in). Main crew and passenger door at front of cabin on port side. Emergency exit and servicing door at rear of cabin on starboard side.

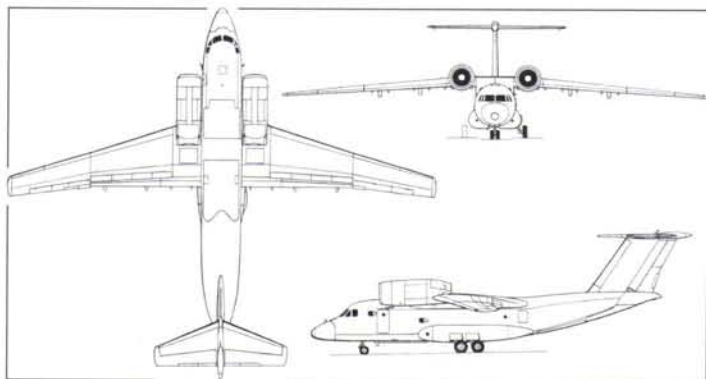
SYSTEMS: Air conditioning system with independent temperature control in flight deck and main cabin areas; used to refrigerate main cabin when perishable goods carried. Maximum cabin pressure differential 0.49 bar (7.1 lb/sq in). Hydraulic system for landing gear, flaps and ramp. Electrical system powers auxiliary systems, flight deck equipment, lighting and mobile hoist. Thermal de-icing system for leading-edges of wings and tail unit (including tailplane slat), engine air intakes and cockpit windows. Provision for TA-12 APU in starboard landing gear fairing. This can be used to heat cabin; under cold ambient conditions, servicing personnel can gain access to major electric, hydraulic and air conditioning components without stepping outside.

AVIONICS: Comms: HF com, VHF com/nav, 'Odd Rods' IFF standard.

Radar: Navigation/weather radar in nose.

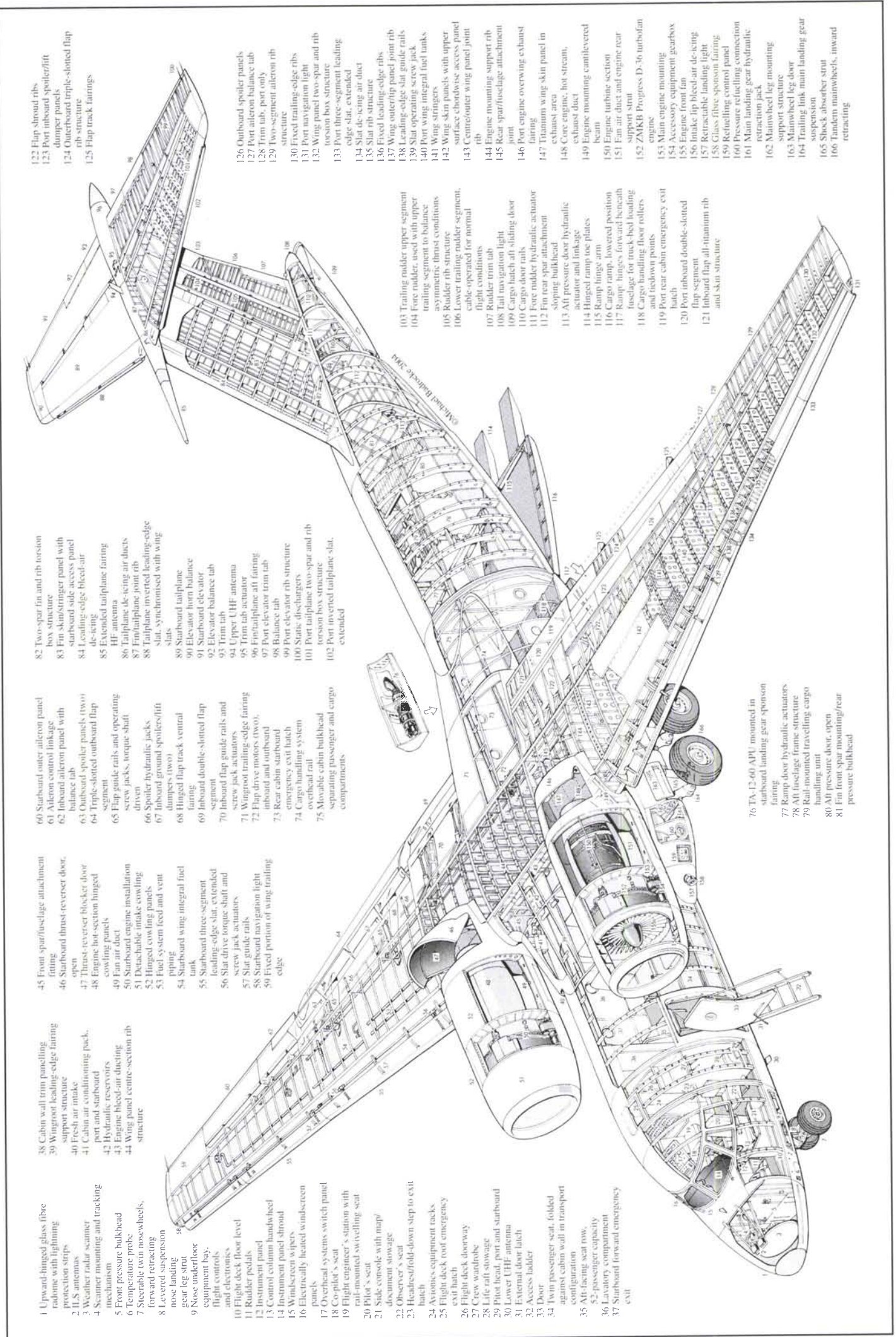
Flight: ADF. Compatible with DME, Tacan, VOR, ILS and SP systems. Doppler-based automatic navigation system, linked to onboard computer, is preprogrammed before take-off on push-button panel to right of map display.

Instrumentation: Failure warning panels above windscreen display red lights for critical failures, yellow lights for non-critical failures, to minimise time spent on monitoring instruments and equipment.



Antonov An-74 ('Coaler-B') STOL transport (two ZMKB Progress/Ivchenko D-36 turboprops) (Dennis Punnett)

0507543



Antonov An-74TK-100, cutaway drawing key (Michael Badrocke)

0581426

An-74 has enhanced avionics, including GPS, GPWS and TCAS 2000 in latest production. Five-screen 'glass cockpit' with twin HUDs under development by 2003.

EQUIPMENT: Removable mobile winch, capacity 2,500 kg (5,511 lb), assists loading. Cargo straps and nets stowed in lockers on each side of hold when not in use. Provision for roller conveyors in floor.

DIMENSIONS, EXTERNAL:

Wing span	31.89 m (104 ft 7½ in)
Wing aspect ratio	10.3
Length overall	28.07 m (92 ft 1¼ in)
Fuselage: Max diameter	3.10 m (10 ft 2 in)
Height overall	8.65 m (28 ft 4½ in)
Wheel track	4.09 m (13 ft 5 in)
Wheelbase	8.68 m (28 ft 5¾ in)
Min loading clearance beneath rear fuselage	2.80 m (9 ft 2¼ in)
Distance between engine centrelines	4.15 m (13 ft 7½ in)
Crew/passenger door: Height	1.65 m (5 ft 5 in)
Width	0.90 m (2 ft 11¼ in)
Rear-loading door: Length	7.10 m (23 ft 3½ in)
Width	2.40 m (7 ft 10½ in)
Height to sill	1.54 m (5 ft 0¾ in)

DIMENSIONS, INTERNAL:

Cabin: Length, An-74: excl ramp	10.50 m (34 ft 5¼ in)
incl ramp	14.30 m (46 ft 11 in)
Width: at floor level	2.15 m (7 ft 0½ in)
max	2.50 m (8 ft 2½ in)
Height	2.20 m (7 ft 2½ in)
Floor area: An-74T	22.5 m² (242 sq ft)
Ramp area	8.2 m² (88.3 sq ft)
Volume: An-74T (total)	73.3 m³ (2,589 cu ft)

AREAS:

Wings, gross	98.53 m² (1,060.6 sq ft)
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WEIGHTS AND LOADINGS (A: An-72, C: An-74, D: An-74 Salon, E: An-74-200, F: An-74T-200 and An-74TK-200):

Weight empty: A	19,050 kg (42,000 lb)
F	21,820 kg (48,105 lb)
Max fuel: A, C, D, E, F	13,200 kg (29,100 lb)
Max payload: C, D	7,500 kg (16,535 lb)
A, E, F	10,000 kg (22,045 lb)
Max T-O weight:	
from 1,800 m (5,905 ft) runway:	
C	34,500 kg (76,060 lb)
from 600–800 m (1,970–2,630 ft) runway:	
A	31,200 kg (68,784 lb)
C	34,800 kg (76,720 lb)
D, E, F	36,500 kg (80,468 lb)
Max landing weight: C, D, E, F	33,000 kg (72,750 lb)

PERFORMANCE (An-72, A: at T-O weight of 31,200 kg; 68,784 lb, B: at T-O weight of 27,500 kg; 60,625 lb on 1,000 m; 3,280 ft unprepared runway, C, D, E, F, An-74 series as above):

Max level speed at 10,000 m (32,810 ft):	
A	380 kt (705 km/h; 438 mph)
Max level speed at 10,100 m (33,135 ft):	
C, D, E, F	377 kt (700 km/h; 434 mph)
Cruising speed at 10,000 m (32,810 ft):	
A, B	297–324 kt (550–600 km/h; 342–373 mph)
Approach speed: A	97 kt (180 km/h; 112 mph)
Service ceiling: A	10,700 m (35,100 ft)
B	11,800 m (38,720 ft)
F	10,100 m (33,140 ft)
Service ceiling, OEI: A	5,100 m (16,740 ft)
B	6,800 m (22,300 ft)
T-O run: A	930 m (3,055 ft)
B	620 m (2,035 ft)
T-O to 10.7 m (35 ft): A	1,170 m (3,840 ft)
B	830 m (2,725 ft)
Landing run: A	465 m (1,525 ft)
B	420 m (1,380 ft)
Max length of runway required:	
C, D	1,200–1,800 m (3,940–5,905 ft)
E, F	1,400–2,150 m (4,595–7,055 ft)
Range, 45 min reserves:	
A with max payload	430 n miles (800 km; 497 miles)
A with 7,500 kg (16,535 lb) payload	1,080 n miles (2,000 km; 1,240 miles)
A with max fuel	2,590 n miles (4,800 km; 2,980 miles)
B with 5,000 kg (11,020 lb) payload	430 n miles (800 km; 497 miles)
B with max fuel	1,760 n miles (3,250 km; 2,020 miles)
F with 10,000 kg (22,046 lb) payload	809 n miles (1,500 km; 932 miles)
F with 5,000 kg (11,023 lb) payload	1,943 n miles (3,600 km; 2,236 miles)
Range, 1 hour reserves:	
C, F with 7,500 kg (16,535 lb) payload	944 n miles (1,750 km; 1,087 miles)
E with 7,500 kg (16,535 lb) payload	1,160 n miles (2,150 km; 1,336 miles)
C, E with 5,000 kg (11,020 lb) payload	1,511 n miles (2,800 km; 1,739 miles)
F with 5,000 kg (11,020 lb) payload	1,403 n miles (2,600 km; 1,615 miles)
C with max fuel and 800 kg (1,763 lb) payload	
	2,375 n miles (4,400 km; 2,734 miles)
D with max fuel and 16 passengers	2,429 n miles (4,500 km; 2,796 miles)
E with max fuel and 2,500 kg (5,511 lb) payload	
	2,294 n miles (4,250 km; 2,640 miles)
F with max fuel and 5,000 kg (11,020 lb) payload	
	2,321 n miles (4,300 km; 2,671 miles)
Endurance: F	6 h 50 min

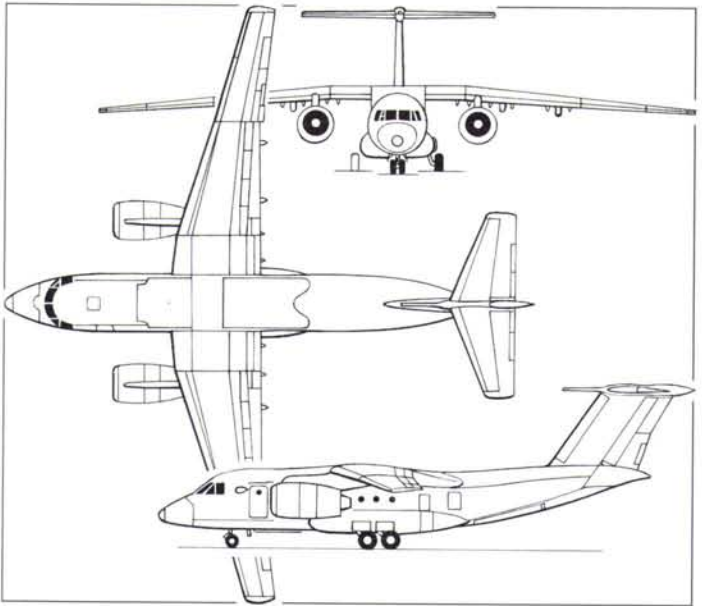
ANTONOV An-74-300

TYPE: Twin-jet freighter.
PROGRAMME: First variant, An-74TK-300, announced mid-1998. Prototype An-74TK-300 modified by KHGAPP from An-74 c/n 1910; work began December 1999; first official flight (UR-74300) 20 April 2001; international debut at Paris Salon, June 2001; certification trials completed July 2002 after 219 sorties; AP-25 certificate approved 9 September 2002.



Antonov An-74-300 used by Ukrainian government (KhGAPP)

1158195



Antonov An-74T-300 STOL transport (James Goulding)

1158196

CURRENT VERSIONS: An-74 derivative in which podded, underslung engines, incorporating thrust-reversers, replace the normal An-72/74 installation.

An-74TK-300: Baseline transport for 52 passengers. As described.

An-74MP-300: Proposal announced 2002. Maritime patrol version of An-74TK-300; also capable of carrying 22 paratroops, or 44 soldiers or 16 stretchers. Provision for GSh-23L gun, rockets and 100 kg bombs.

An-74TK-300D: Executive transport for 30 passengers.

CUSTOMERS: Initial order for two from Ukraina airline for operation on behalf of government in VIP role. These comprise prototype, subsequently registered UR-LDK (Leonid Danilovich Kuchma) and second aircraft, UR-YVA (Yushchenko, Viktor Andreyevich). MoU for 25 from Aeroflot, signed June 2002; Chinese interest in two aircraft reported late 2002. Neither pursued to contract stage but home orders anticipated from UkrTransLeasing. In 2006, two An-74TK-300s on assembly line earmarked for Libya and Laos.

COSTS: USD12 million to USD14 million (2003).

DESIGN FEATURES: Revised engine installation decreases T-O run, despite loss of Coanda effect; new power plants reduce maintenance requirements and fuel consumption (up to 29 per cent); new position simplifies access.

Cabin enlarged by repositioning of partitions; integral airstairs; upgraded air conditioning; improved instrumentation.

POWER PLANT: Two 63.7 kN (14,330 lb st) Progress D-36-4A turbofans.

AVIONICS: Comms: SO-72M transponder, Arlekin-DA HF radio, twin Orlan-85ST VHF, Lainer-MVL PA system, Opal-B CVR, twin Cospas ELT. Optional Arlekin-DA HF radio. Radar: Buran-74T weather radar.

Flight: NVS-74TM Malva navigation system, SAU-74-03 autopilot, EGPWS, twin SH-3301 GPS, twin A-037 radar altimeters, twin KURS-93M VOR/ILS, twin SD-75 DME, Veer-M Shoran, twin ARK-22 ADF and TCAS 2000. Optional SAU-104/74 digital autopilot.

Instrumentation: 'Glass cockpit' FMS optional.

Generally as for An-74, except that below.

DIMENSIONS, EXTERNAL:

Tailplane span	10.00 m (32 ft 9¾ in)
Wheel track (tread centre)	4.07 m (13 ft 4¼ in)
Wheelbase (mean)	8.08 m (26 ft 6 in)
Distance between engine centrelines	8.90 m (29 ft 2½ in)

DIMENSIONS, INTERNAL (VIP version):

Cabin: Length	10.49 m (34 ft 5 in)
Width	2.20 m (7 ft 2½ in)
Height	2.50 m (8 ft 2½ in)
Volume	54.0 m³ (1,907 cu ft)

AREAS:

Wings, gross	98.62 m² (1,061.5 sq ft)
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WEIGHTS AND LOADINGS:

Max	10,000 kg (22,045 lb)
Max fuel weight	13,210 kg (29,123 lb)
Max T-O weight	36,500 kg (80,468 lb)
Max landing weight	33,000 kg (72,752 lb)

PERFORMANCE:

Max level speed	378 kt (700 km/h; 435 mph)
Max cruising speed	313 kt (580 km/h; 360 mph)
Service ceiling	10,100 m (33,140 ft)
Balanced field length	2,050 m (6,725 ft)
Range: with nine passengers and 2,300 kg (5,070 lb) cargo	
	1,781 n miles (3,300 km; 2,050 miles)
with eight passengers	2,375 n miles (4,400 km; 2,734 miles)
ferry	2,807 n miles (5,200 km; 3,231 miles)

ANTONOV An-128

TYPE: Regional jet airliner; twin-turboprop airliner.

PROGRAMME: Revealed October 2004, when joint development agreement reached with PZL of Poland. No further announcements by mid-2006.

DESIGN FEATURES: T-tail, high-wing transport with either turboprop or turbofan engine on each wing and accommodation for 21 passengers. Reportedly requested by Libya.

ANTONOV An-140

TYPE: Twin-turboprop airliner.

PROGRAMME: Announced at Paris in June 1993 as An-24 replacement; preliminary design finalised April 1994; two prototypes with TV3-117 engines and static test airframe constructed at Kiev; rolled out 6 June 1997; first flight (UR-NT0) at Kiev-Svyatoshino (landing at Gostomel flight test centre, as base for certification trials) 17 September 1997; second airframe (0102) for static tests; second flying prototype (UR-NTP) rolled out 11 December 1997 and flew 26 December. Third (0104; first production), due to fly at Kharkov, early 1999, and undertake electromagnetic compatibility and climatic tests but maiden sortie delayed until 11 October 1999; this aircraft (UR-PWO) flew 41 sorties towards certification.

Certification programme of 940 hours began August 1998 and completed in early 2000; included cold trials at Arkhangelsk (by UR-NT0 between 29 March and 1 May 1999, and by UR-NTP for 10 days in January 2000) and hot-and-high trials in Uzbekistan and Kyrgyzstan (by UR-NTP, concluding 3 September 1999). Following first series of flight testing, tailplanes of prototypes modified to obviate propwash-induced vibration, gaining 15° dihedral and shortened elevator horn balance. An-140's 1,000th hour flown (by UR-NTP) on 12 January 2000. Trials concluded on 26 March 2000 after 1,286 hours in 1,138 sorties. Certification in Russia (AP-25) and Ukraine was achieved on 25 April 2000 coincident with that of TV3-117VMA-SBM1 engine and AV-140 propeller. Meets FAR Pt 25 airworthiness, Pt 34 emissions and Pt 36 noise requirements.

Series production began 1999 at KhGAPP, Kharkov (where wings for prototypes were built) and at Aviakor, Samara, Russian Federation.

Aviakor production intended to be 10 in 2000 (first in July) and to reach 30 per year by 2001, but reduced to combined total of eight in 2000–01; five under assembly at Aviakor by May 2000, but first (confusingly, RA-14001) not rolled out until 25 December 2003, being one of two ordered in 2003 by Samara Airlines; first flight delayed until 2 August 2005 and aircraft repainted as RA-41250 of Yakutia for display at Moscow Salon later in same month.

KhGAPP deliveries began with UR-14001 to Odessa Airlines on 4 March 2002. This made type's Western debut at Farnborough in July 2002. Six production aircraft supplied by KhGAPP before change to An-140-100, first of which delivered on 26 April 2004.

Production share agreement of 1998 assigns empennage to Antonov; engine nacelles, wing and associated control surfaces to KhGAPP; landing gear to Aviagregat at Samara and Youzhmash at Dnepropetrovsk; and fuselage to Aviakor (incorporating Avio Interiors fittings from Italy).

Agreement signed December 1995 for assembly by HESA at rate of 12 a year from 1999, progressing to local parts manufacture, in new plant at Esfahan, Iran, with Ukrainian assistance; first two kits shipped from KhGAPP to Iran by late 2000; initial aircraft first flown 7 February 2001. Iranian type certificate issued 14 April 2003. Total 10 kits delivered by early 2005, by which time two were flying.

In first four years of commercial operation (to 2006), An-140s flew 21,367 hours in 12,667 sorties.

CURRENT VERSIONS: **An-140:** Initial six production aircraft only; replaced in 2004 by -100.

An-140T: Proposed 6 tonne freighter with large door, port side, rear. Convertible **An-140TK** will be similar, but with 5 tonne payload and up to 50 passengers.

An-140VIP: Executive version; range 2,159 n miles (4,000 km; 2,485 miles). Prototype converted by InterAMI of Kharkov from former Odessa Airlines aircraft and shown at Kish, Iran, January 2005.

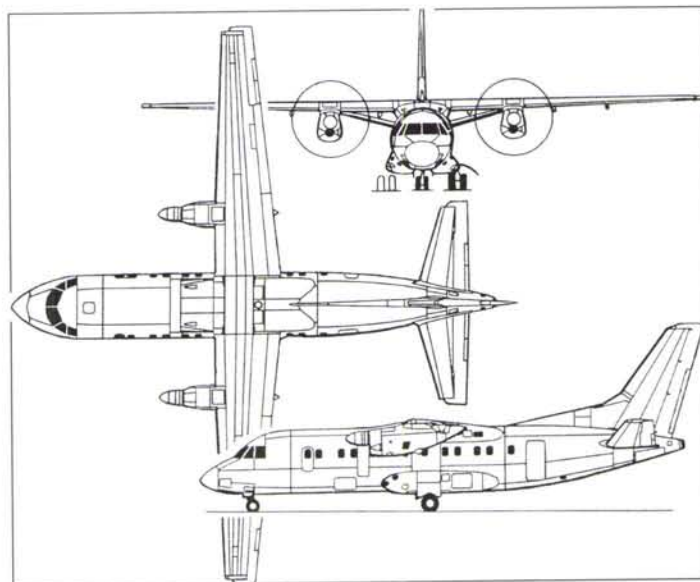
An-140-100: Improved version; advanced engine nacelle design, increased tankage and wing span increased by 1.00 m (3 ft 3¼ in) giving 21,500 kg (47,399 lb) MTOW and further 162 n miles (300 km; 186 miles) of range. Standard version from 2004. (Series 100 originally proposed in 1997 as 68-seat version with 3.80 m; 12 ft 5½ in fuselage stretch.) As described.

An-142: Under development for 2001 first flight; forward-retracting rear loading ramp similar to An-26. No further reports.

Ir.An-140: Licence-built by HESA in Iran.

An-140 Military: Patrol, surveillance, photographic and similar variants proposed for military operators.

CUSTOMERS: Air Ukraine letter of intent for up to 40 by 2010 signed 17 September 1997 (first flight); initial four firm conversions made June 1999 (for manufacture at Kharkov),



Antonov An-140-100 short-range transport (James Goulding)

1158198

specifying deliveries from 2000; however, initial recipient from Ukrainian production was Ikar Airlines, with five on order from January 2000 contract, first being UR-PWO, delivered in 2001, following testing at Antonov; this soon disposed of, however, and no more supplied to Ikar. Initial permanent operator, Odessa Airlines, ordered five from Kharkov production, of which first (UR-14001, the former UR-PWO) entered revenue-earning service on 29 March 2002, having been handed over to Ukrtransleasing on 4 March.

Kharkov only recorded as having delivered one (4K-AZ49 to Azerbaijan Airlines on 29 March) in 2005; third Azerbaijani aircraft completed, but not delivered by early 2006, following crash of first machine. One supplied by Samara in 2005 and two due in 2006 (all to Yakutia); none reported from Iran in 2005. Refer to table for further customers.

Launch order for Ir.An-140 was 20 for Iran Asseman Airlines; Iran Air also will be operator; Iranian licence initially for 80 aircraft, but interest reported, late 1998, in building further 160.

COSTS: USD9.8 million (2006).

DESIGN FEATURES: Light transport, designed to be capable of autonomous operation from airfields with unprepared runways at all altitudes and in all weathers, providing airline-standard comfort. International certification and various engine options to maximise sales prospects. Conventional high-wing monoplane; tapered wing with unswept leading-edge; sweptback fin and tailplane, latter with 15° dihedral; engines mounted underwing. Maintenance target of 6.5 mmh/ft. Service life 50,000 landings/50,000 hours/25 years.

FLYING CONTROLS: Conventional and manual. Control surfaces all horn balanced; ailerons with servo tab in each (plus trim tab starboard); elevator with two-section trim/servo tab each side; rudder with large single tab. Two-section flaps in each wing; auto spoiler ahead of each outboard flap section.

STRUCTURE: Largely of aluminium, with some titanium.

LANDING GEAR: Retractable tricycle type by Pivdennyi; twin Rubin wheels on each unit; steerable nosewheels retract forward, mainwheels into fairings each side of lower fuselage. Mainwheels KT-231, tyre size 810×320-330; nosewheels KN-44, tyre size 600×220-254. Rubin braking system on mainwheels. Able to operate from gravel or unpaved fields.

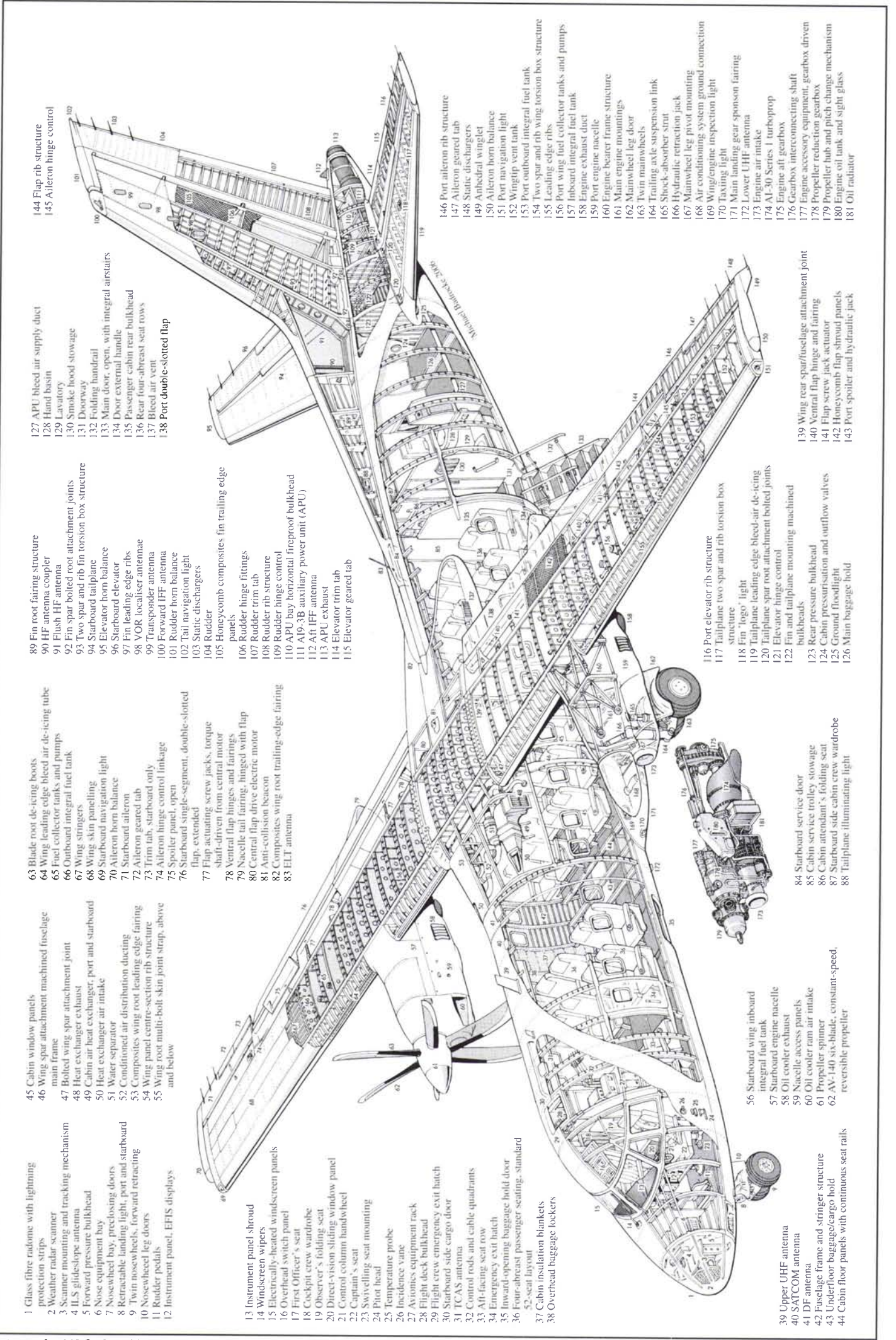
POWER PLANT: Two 1,839 kW (2,466 shp) Ivchenko TV3-117VMA-SBM1 (built at Zaporozhye, Ukraine, by Motor-Sich), driving AV-140 feathering and reversible propellers. FED fuel-management system; Star engine control system.

ACCOMMODATION: Flight crew of two, plus cabin attendant; basic seating for 52 passengers, four-abreast with centre aisle, at 78 cm (31 in) pitch, or 48 at 81 cm (32 in) pitch. Main passenger door with airstairs, at rear of cabin on port side, with service door (also emergency exit Type I) opposite; Type III emergency exit port side at front of cabin; cargo door (and Type I exit) starboard side, front. Coat stowage, galley and lavatory at rear of cabin. Baggage/freight compartment at rear of cabin, plus forward underfloor baggage hold, with door on port side. Cargo door on starboard side, forward part of cabin floor reinforced, and



Kharkov-built Antonov An-140 operated by Ukrainian government (Yefim Gordon)

1158205



Antonov An-140 Series 100, cutaway drawing key (Michael Badrocke)

ANTONOV An-140 CUSTOMERS

Airline	Order	Remarks
Kharkov production		
Aeromost	3	First aircraft UR-14002 delivered 3 Aug 02
Air Ukraine	(4)	None received
Azerbaijan Airlines	4	First aircraft 4K-AZ48 delivered 27 Nov 04; revenue service 3 Dec 04
Ikar Airlines	(5)	First production aircraft used briefly from December 2001; none further
Il'ich-Avia	2	First aircraft UR-14007 delivered 26 Apr 04
Motor Sich	1	UR-14005 delivered 23 May 03
Odessa Airlines	5	First aircraft UR-14001 handed over (to Uktransleasing) 4 Mar 02; revenue service 29 Mar 02
TOJ-Airlines	1	Ordered 27 Oct 04
Volga Dnepr	(5)	Letter of intent Oct 02
Samara production		
Aeroflot	(50)	Letter of intent, mid-1999; PW127 engines
Air Libya	(5)	Ordered Jun 03
Buryatia Airlines	(2)	Ordered Dec 02
Ilyushin Finance	(25)	Ordered 17 Jul 06 by Samara local government
Samara Airlines	(15)	See Ilyushin Finance
Sibaviatrans	(3)	Ordered Dec 02
Yakutia	(3)	One An-140; two An-140-100s; five options

Notes: Iranian production not included

detachable equipment provided, enabling 1,650 to 3,650 kg (3,638 to 8,046 lb) of bulk cargo and 36 to 20 passengers to be carried with forward rows of seats removed. Overhead baggage lockers. Accommodation ventilated and pressurised.

SYSTEMS: Motor-Sich AI-9-3B 16 kW APU in tailcone. FED hydraulic system; Nauka air conditioning. Kommunar anti-icing and air conditioning control systems. Auxilec generators; Eros oxygen system.

Avionika SAU 28-02 analogue flight control system. Digital ICVSP-140-01 ADS optional.

AVIONICS: Commis: Arlekin-D-A HF/ radio, twin Orlan-85ST VHF, AVSA-MVL PA system. Opal-B CVR, R-855A1 emergency VHF/UHF, SO-72M transponder, Satori ELT96 ELT. Muza-A entertainment system.

Radar: Buran A-140 weather radar
Flight: ARK-25 ADF, Veer-M Shoran, Kurs-93M VOR/ILS, RMI-3 RMI, SN-3301 GPS, VND-94 VOR, A037 D1 radio altimeter, TCAS-94 and SSPZ-2000 GPWS.

DIMENSIONS, EXTERNAL:	
Wing span: An-140	24.505 m (80 ft 4¾ in)
An-140-100	25.505 m (83 ft 8¼ in)
Length overall	22.605 m (74 ft 2 in)
Height overall	8.225 m (26 ft 11¾ in)
Wheel track (c/l shock-absorbers)	3.18 m (10 ft 5¼ in)
Wheelbase	8.125 m (26 ft 7¾ in)
Propeller diameter	3.72 m (12 ft 2½ in)
Distance between propeller centres	8.20 m (26 ft 10¾ in)
Main cabin door: Height	1.68 m (5 ft 6¼ in)
Width	0.915 m (3 ft 0 in)
Emergency exit: Height	1.19 m (3 ft 10¾ in)
Width	0.51 m (1 ft 8 in)
Service door: Height	1.29 m (4 ft 2¾ in)
Width	0.62 m (2 ft 0½ in)
Cargo door: Height	1.29 m (4 ft 2¾ in)
Width	0.985 m (3 ft 2¾ in)
Underfloor baggage hold door:	
Height	0.93 m (3 ft 0½ in)
Width	1.10 m (3 ft 7¼ in)

DIMENSIONS, INTERNAL:	
Cabin: Length:	
excl flight deck, galley/lavatory area	10.50 m (34 ft 5½ in)
incl galley/lavatory and baggage	14.62 m (47 ft 11½ in)
Max width	2.60 m (8 ft 6¼ in)
Max height	1.90 m (6 ft 2¾ in)
Volume: total	65.5 m³ (2,313 cu ft)
Aft baggage compartment: Volume	6.1 m³ (215 cu ft)
Underfloor baggage hold: Length	3.98 m (13 ft 0¾ in)
Max width	1.45 m (4 ft 9 in)
Max height	0.545 m (1 ft 9¾ in)
Volume	3.0 m³ (106 cu ft)
Overhead baggage lockers:	
Volume (total)	2.4 m³ (85 cu ft)

WEIGHTS AND LOADINGS (An-140-100):	
Operating weight empty	13,200 kg (29,101 lb)
Baggage capacity	1,840 kg (4,057 lb)
Max payload	6,000 kg (13,227 lb)
Max fuel weight	4,680 kg (10,318 lb)
Max T-O weight	21,500 kg (47,399 lb)
Max power loading	5.85 kg/kW (9.61 lb/shp)

PERFORMANCE (An-140-100):	
Max cruising speed	290 kt (537 km/h; 334 mph)
Econ cruising speed	248 kt (460 km/h; 286 mph)
Landing speed	109 kt (202 km/h; 125 mph)
Nominal cruising altitude	FL200
Max certified altitude	7,620 m (25,000 ft)
T-O run	880 m (2,890 ft)
Landing run	530 m (1,740 ft)
Range, no reserves:	
with 6,000 kg (13,227 lb) payload	928 n miles (1,720 km; 1,068 miles)
with 52 passengers	1,495 n miles (2,770 km; 1,721 miles)
with 42 passengers	1,835 n miles (3,400 km; 2,112 miles)
ferry	2,176 n miles (4,030 km; 2,504 miles)

ANTONOV An-148

TYPE: Regional jet airliner.

PROGRAMME: In September 2001, Antonov revealed that it was working on the design of an 80-seat, twin-jet (Progress D-36-5AF), 1,349 n mile (2,500 km; 1,553 mile) range airliner. Configuration is similar to the An-74T-300; stretched and shrunk versions are also planned.



Model of Antonov An-148T military rear-loading freighter (Paul Jackson)

1159094

Series manufacture originally planned to be by KhGAPP at Kharkov and VASO at Vorenezh, Russia. Antonov and UUAP signed agreement for licensed production in February 2002, but this not taken further. Ukrainian participants include Motor Sich and ZhEDB Progress. By September 2004, envisaged that Aviant would be sole source, employing subassemblies from KhGAPP (centre fuselage) and VASO (empennage). Antonov and VASO signed production licence on 25 November 2005 and VASO deliveries to Ukraine began in early 2006.

The first of three (two flying; one static) Antonov-built prototypes was under construction at Kharkov by early 2002; fuselage removed from jigs 28 February 2003; unofficially rolled out 25 September 2004; formal presentation 15 October 2004; first flight (UR-NTA), from Svyatoshino to Antonov test base at Gostomel 17 December 2004; second prototype (UR-NTB), with airline interior, flew 19 April 2005; total 117 sorties by mid-June 2005 (both aircraft); Winter trials in Yakutia, January 2006. Static test airframe (0103) employed by Antonov; certification due in late 2006.

CURRENT VERSIONS: **An-148-100B:** Baseline version; 70 to 80 passengers; range up to 2,159 n miles (4,000 km; 2,485 miles). KrasAir aircraft equipped for eight first- and 60 economy passengers.

An-148-100A: Short-haul version; 75 passengers; range 1,187 n miles (2,200 km; 1,367 miles).

An-148-100E: Long haul, 75-seat version; range 2,753 n miles (5,100 km; 3,169 miles). **An-148-100E1:** Long-haul version; 55 passengers in three-class cabin over 3,779 n miles (7,000 km; 4,349 miles); additional fuel tanks in baggage hold.

An-148-100E2: Executive transport; between 10 and 30 passengers; range 4,697 n miles (8,700 km; 5,405 miles). Baggage hold fuel. Second An-148 prototype acquired by KrasAir in 2006 as An-148VIP with 18 seats.

An-148-C1: Small parcels transport; total payload 10,500 kg (23,149 lb), loaded by conveyor belt via two side doors and underfloor baggage hatch.

An-148-C2: Palletised cargo transport, including LD1, LD2, LD3, LD3-46, LD3-46W, LD4, LD8 and AED containers. Maximum pallet size 2.24 × 3.18 m (88 × 125 in). Cargo door 3.40 m (11 ft 1¾ in) wide and 1.92 m (6 ft 4 in) high, port, rear; reinforced floor with roller track.

An-148T: Rear loading ramp freighter.

An-148-200: Stretched version for 100 passengers. Available as **200A** with range up to 1,619 n miles (3,000 km; 1,864 miles) and **200B** with 2,429 n mile (4,500 km; 2,796 mile) range. Fuselage plugs of 3.03 m (9 ft 11¼ in) ahead of wings and 2.20 m (7 ft 2½ in) aft.

CUSTOMERS: Volga-Dnepr letter of intent for three signed October 2002. Aeroflot lease agreement for 30 An-74s will be transferred to An-148. Aerosvit letter of intent for 10, 2004.

First firm order, May 2005, from KrasAir for 10, of which five for delivery in 2006; however, by mid-2006 Antonov naming SCAT of Kazakhstan as recipient of first seven production aircraft in 2006-07. Pulkovo Airlines to acquire 18 (replacing requirement for Tupolev Tu-334s), beginning with three in 2006. Initial aircraft for these two customers included in first production batch of 14 An-148s funded by Ilyushin-Finance from VASO plant in January 2005.

COSTS: GBP12.7 million (2005).

DESIGN FEATURES: Generally as for Antonov An-74, but FBW control system. Wing developed by KhGAPP. Intended parameters include 99.4 per cent dispatch reliability; 300 h/month utilisation; and 1.3 mmh/ft. Engine change in 2 hours. AP/FAR/EASA Pt 25 certification; ICAO IV noise/environmental impact.

POWER PLANT: Two progress (ZMKB) D436-148 turbofans, each of 65.6 kN (14,740 lb st). Provision for alternative engines. Fuel capacity approx 15,100 litres (3,989 US gallons; 3,322 Imp gallons) in all versions.

ACCOMMODATION: Flight deck crew of two, plus jump-seat. Seating in cabin as per variant. Passenger door, front, port; service doors, forward, starboard and rear port. Front and rear underfloor baggage holds, each with door, starboard. Cabin baggage compartment, rear, with door, starboard. Crew wardrobe, passenger wardrobe and lavatory forward; galley and lavatory rear, ahead of baggage compartment.

EQUIPMENT: ZMKB Progress AI-450MS APU.

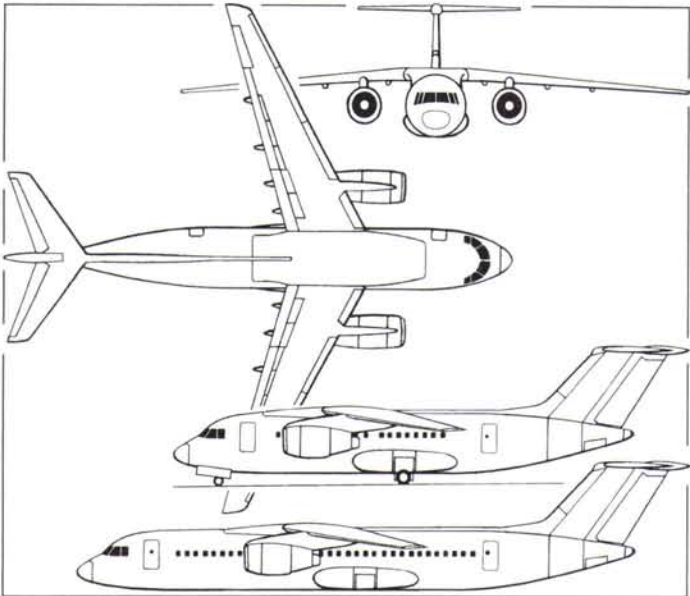
AVIONICS: Two-crew cockpit with five-screen display by Aviapribor. Honeywell or Rockwell Collins equipment.

DIMENSIONS, EXTERNAL (An-148 100 and -200):



Antonov An-148 second prototype (Yefim Gordon)

1158248



General arrangement of the Antonov An-148-100 with additional side view of An-148-200 (James Goulding)

1162246

Wing span	28.91 m (94 ft 10¼ in)
Length overall: 100	29.13 m (95 ft 6¾ in)
200	34.36 m (112 ft 8¾ in)

Height overall: 100	8.20 m (26 ft 10¾ in)
200	8.60 m (28 ft 2½ in)
Baggage door, underfloor (forward, stbd):	
Height	1.00 m (3 ft ¾ in)
Width	1.50 m (4 ft 11 in)
Baggage door, underfloor (rear, stbd):	
Height	1.00 m (3 ft ¾ in)
Width	1.00 m (3 ft ¾ in)
Baggage door, cabin (rear, stbd):	
Height	1.00 m (3 ft ¾ in)
Width	0.75 m (2 ft 5½ in)
DIMENSIONS. INTERNAL:	
Cabin: Height: max	2.00 m (6 ft 6¾ in)
under baggage lockers	1.40 m (4 ft 7 in)
Baggage hold: Height: max (centre)	0.74 m (2 ft 5¼ in)
min (sides)	0.44 m (1 ft 5¼ in)
Width: max (base)	2.11 m (6 ft 11 in)
min (top)	1.86 m (6 ft 1¼ in)
Volume: forward	7.5 m³ (152 cu ft)
rear	4.3 m³ (152 cu ft)
WEIGHTS AND LOADINGS (An-148-100 and -200):	
Max payload	9,000 kg (19,842 lb)
Max fuel weight	12,100 kg (26,676 lb)
Max T-O weight:	
100A	37,130 kg (81,857 lb)
100B	39,900 kg (87,964 lb)
100E, E1, E2	43,050 kg (94,908 lb)
PERFORMANCE (estimated):	
Cruising speed: max	470 kt (870 km/h; 541 mph)
econ	443 kt (820 km/h; 510 mph)
Cruising altitude	11,600 m (38,060 ft)
Required runway length: 100	2,300 m (7,545 ft)
200	2,100 m (6,890 ft)
Range: with max payload	1,906 n miles (3,530 km; 2,193 miles)
with max fuel	3,552 n miles (6,580 km; 4,088 miles)

ANTONOV An-148 REPORTED ORDERS

Notes: It has proved impossible to differentiate between claimed orders, actual orders, options, commitments and 'wish lists', even when reported by supposedly authoritative sources. Those marked * obtained on lease-purchase via Ilyushin Finance.

Airline	Version	Qty	Remarks
Aeroflot		30	Planned lease
Aerosvit		10	"Guaranteed" in magazine claim, 2005
Berkut			"Signed agreement" (Antonov)
Cubana*	-100B	3	Order Moscow Air Show 2005
Donbassaero		5	"Guaranteed" in magazine claim, 2005
KrasAir*	-100B	10	"Signed agreement" (Antonov)
	-100B	5	Option
	-VIP	1	Second prototype purchased in 2006: joint use with IFK-Jets
Polet*	-100B	15	Signed Moscow Air Show 2005
	An-148T	5	Signed Moscow Air Show 2005
Pulkovo*	-100B	8	"Signed agreement" (Antonov)
	-100B	10	Option
SCAT	-100	7	Launch operator
Ukrainian?		3	"Guaranteed" in magazine claim, 2005
Volga-Dnepr	-100B	3	Intention; Moscow 2005
	-100C	3	Intention; Moscow 2005
	An-148T	2	Intention; Moscow 2005
Yuzhnye		6	"Guaranteed" in magazine claim, 2005

Total: In early 2006, Antonov reported 41 aircraft covered by "signed delivery agreements" with Berkut, KrasAir, Pulkovo and Skat, omitting to mention Polet and Cubana orders announced earlier.

IKAR

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'Ikar' Aero Club was founded in 1995 to develop, build and provide engineering and maintenance support for light aircraft. In addition to the Ai-10, it has built the Ai-9 Lis of

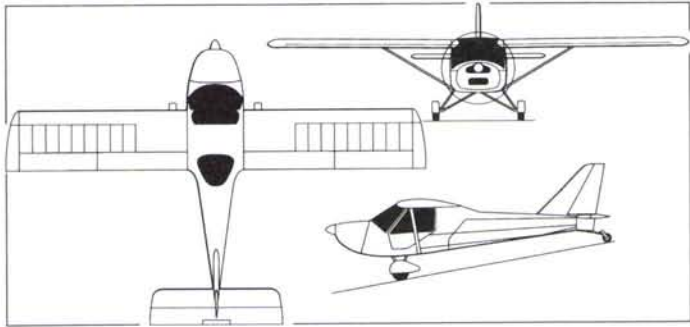
similar configuration; and Aist pod-and-boom ultralight. Projects include the Zhuravlik powered hang-glider; four-seat Ai-20 Dedal; Ai-30 Chirok four-seat amphibian; Ai-40 Leleka agricultural sprayer; tandem-seat Ai-50 Skvorets; Ai-60 (also known as Ai-240) four-seat light twin; and Ai-70 agricultural sprayer.

IKAR Ai-10 IKAR

TYPE: Side-by-side ultralight.
PROGRAMME: First flown in 1999. Gained French ultralight approval in October 2002. No recent reports, but marketing proceeding in France, Spain and elsewhere during 2006.



Ikar Ai-10 side-by-side ultralight of a Russian private owner (Yefim Gordon) 1044948



Ikar Ai-10 general arrangement (Paul Jackson) 1159116

COSTS: USD35,000 to USD39,000, according to equipment (2001).
DESIGN FEATURES: High-mounted, constant-chord, strut-braced wing. Sweptback fin and mid-mounted tailplane.
FLYING CONTROLS: Conventional and manual. Flaps.
STRUCTURE: Metal airframe. Fabric-covered wing.
LANDING GEAR: Tailwheel type; fixed.
POWER PLANT: One Rotax flat-four driving a Petrenko P-912-170 three-blade, wooden propeller: 59.6 kW (79.9 hp) Rotax 912 UL; 73.5 kW (98.6 hp) 912 ULS; or 84.6 kW (113.4 hp) 914. Fuel capacity 88 litres (23.2 US gallons; 19.4 Imp gallons).
DIMENSIONS, EXTERNAL:

Wing span	9.06 m (29 ft 8¾ in)
Length overall	6.21 m (20 ft 4½ in)
Height overall	1.70 m (5 ft 7 in)
AREAS:	
Wings, gross	11.74 m² (126.4 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	284 kg (626 lb)
Max T-O weight: Rotax 912 ULS	510 kg (1,124 lb)
Rotax 912 UL	450 kg (992 lb)
PERFORMANCE (Rotax 912 ULS):	
Cruising speed	97 kt (180 km/h; 112 mph)
Stalling speed	27 kt (50 km/h; 32 mph)
Max rate of climb at S/L	360 m (1,181 ft)/min
T-O run	80 m (265 ft)
Landing run	60 m (200 ft)
Range with max fuel	540 n miles (1,000 km; 621 miles)
g limits	+6/-3

IKAR Ai-70

TYPE: Agricultural sprayer.
PROGRAMME: Under development by 2005. No report of progress in subsequent year.
DESIGN FEATURES: Tandem-seat, high-wing, tailwheel design based on Ai-10. Typical working rate of 300 to 530 litres (80 to 140 US gallons; 67 to 117 Imp gallons) per flying hour.
POWER PLANT: One 103 kW (138 hp) LOM M332 four-cylinder, in-line piston engine.
EQUIPMENT: Chemical tank and spraybars.

DIMENSIONS, EXTERNAL:	
Wing span	12.00 m (39 ft 4½ in)
Length overall	7.00 m (22 ft 11½ in)
Height overall	2.75 m (9 ft 0¼ in)
AREAS:	
Wings, gross	18.50 m² (199.1 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	320 kg (705 lb)
Max T-O weight	750 kg (1,653 lb)
PERFORMANCE:	
Normal cruising speed	70 kt (130 km/h; 81 mph)
Stalling speed	38 kt (70 km/h; 44 mph)
Max rate of climb at S/L	210 m (689 ft)/min
Service ceiling	3,500 m (11,480 ft)
T-O run	100 m (330 ft)
Landing run	70 m (230 ft)
Range with max fuel	216 n miles (400 km; 248 miles)
g limits	+4/-2

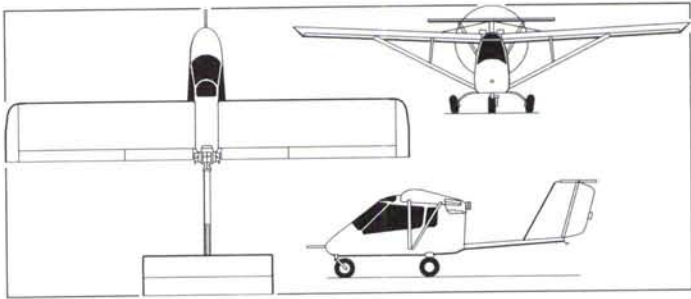
LILIENTAL'

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PRESIDENT: Anatoly Borodin
PRODUCTION DIRECTOR: Yuri Komarovskiy
SALES MANAGER: Alexey Voloshin

The company (which adopts the German spelling of aviation pioneer Otto Lilienthal for marketing in the West) and its predecessors have built 15 types of aircraft, from hang-gliders (first flight 4 September 1975) to twins. Lilienthal was formed by Anatoly Borodin and Valentin Loskov out of the hang-glider club associated with the KhGAPP aircraft plant, transforming into an ultralight club in 1976 and establishing a design bureau within Kharkov factory in 1987.

Lilienthal was established as a firm in 1991, manufacturing the Kh-37 (X-37) Chibis hang-glider and moving two years later to the Kh-32 (X-32) Bekas. By 2003, more than 100 of each had been built, production continuing at a rate of 10 per year. All current types have a Russian type certificate. Manufacture is conducted in close association with related companies Otto Ltd and Gustav Ltd. Lilienthal is also a service centre for Rotax engines and licensed for flying instruction.

It will be noted that the Kh-designations of the Kharkov-designed aircraft of Lilienthal retain the Cyrillic 'X' for Western trading.



Lilienthal X-32 Bekas (Paul Jackson) 0576137

(agricultural) and H (Hydro floatplane) versions. Under a 2003 agreement with Jordan Aerospace Industries, is assembled and marketed in the Middle East as JAI RumBird X-32.

REMZ-Avia of Ryazan, Russia, (www.remz-avia.ru) markets the aircraft as the Sintal, in S-2, S-2UT and S-2SKh variants; cockpit glazing has rounded corners. The Sintal was shown at the Moscow Salon in August 2005, although there has been no evidence of recent production in Ukraine.

CUSTOMERS: Over 100 built by 2004.
COSTS: X-32AT USD15,510 for airframe, or USD22,300 with Rotax, USD33,800 with Rotax 912 and USD34,790 with Rotax 912S, plus tax (2004).
DESIGN FEATURES: Pod-and-boom pusher monoplane, with constant-chord high wing braced by V struts and intermediate struts. T-tail with single bracing strut each side.

Wing section NACA 4412.
FLYING CONTROLS: Conventional and manual. Slotted flaps.
LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring cantilever mainwheel legs. Trailing-link, castoring nosewheel. Mainwheel brakes.
POWER PLANT: Suitable for engines between 60 hp and 100 hp; typically 48.0 kW (64.4 hp) Rotax 582 UL, 59.6 kW (79.9 hp) Rotax 912 or 73.5 kW (98.6 hp) Rotax 912S. VPSH-2 Donchak (or similar) variable-pitch propeller. Normal fuel capacity 40 litres (10.6 US gallons; 8.8 Imp gallons) in fuselage tank; optional additional 50 litres (13.2 US gallons; 11.0 Imp gallons) in wing tanks of Rotax 912-engined versions; total 90 litres (23.8 US gallons; 19.8 Imp gallons) max optional capacity.
EQUIPMENT: Optional spray bars and 120 litre (31.7 US gallon; 26.4 Imp gallon) ventral tank on X-32CX; alternative internal tank mounted on second seat.

DIMENSIONS, EXTERNAL:	
Wing span	9.00 m (29 ft 6¼ in)
Length overall	6.25 m (20 ft 6 in)
AREAS:	
Wings, gross	12.33 m² (132.7 sq ft)
WEIGHTS AND LOADINGS:	
Chemical load (X-32SKh)	120 kg (265 lb)
Max T-O weight: Rotax 582	450 kg (992 lb)
Rotax 912	550 kg (1,212 lb)
PERFORMANCE:	
Max level speed: Rotax 582	85 kt (158 km/h; 98 mph)
Rotax 912	94 kt (175 km/h; 109 mph)
Cruising speed: Rotax 582	67 kt (125 km/h; 78 mph)



REMZ-Avia S-2 Sintal variant of X-32 marketed in Russia with revised door and windscreen shape (Yefim Gordon) 1129593

Stalling speed, power off, flaps down:	
Rotax 582	31 kt (57 km/h; 36 mph)
Rotax 912	37 kt (67 km/h; 42 mph)
Max rate of climb at S/L	240 m (787 ft)/min
T-O run	50 m (165 ft)
Landing run	30 m (100 ft)
Endurance: normal fuel	
max fuel	3 h 20 min
g limits: Rotax 582	
Rotax 912	+4.4/-2.2
	+3.8/-1.9

LILIENTHAL X-34 BEKAS

English name: Snipe
TYPE: Three-seat lightplane.
PROGRAMME: Development of X-32. Briefly marketed in Middle East by Jordan Aerospace Industries as GulfBird X-34, but discontinued by 2006. Options include Spasatel (Rescuer) medical evacuation version.

United Kingdom

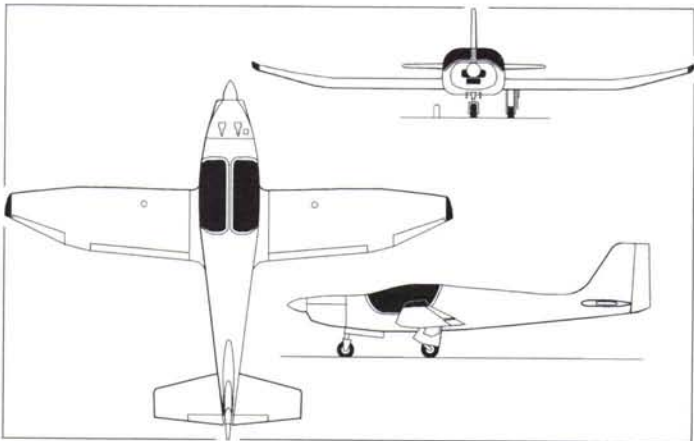
ATG
ADVANCED TECHNOLOGIES GROUP

Renamed SkyCat.

AVIATION ENTERPRISES

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MANAGING DIRECTOR: Angus M Fleming

Previously trading as AMF Aviation Enterprises, the company built 40 production examples of the Chevvron 2-32 side-by-side seat ultralight between 1987 and 1998, then turning its attention to development of the Magnum, which was nearing certification in 2006. Aviation Enterprises is a CAA-approved organisation specialising in design, development and manufacturing for the aerospace industry, its other products including airship gondolas, composites propellers, tidal turbine blades, wind tunnel fan blades, camera booms and motorcar trailers.



Aviation Enterprises Magnum (Paul Jackson) 1158131

AVIATION ENTERPRISES MAGNUM

TYPE: Two-seat lightplane; side-by-side kitbuilt.
PROGRAMME: Preliminary design began 1990; complete by 1992, when one-third scale model tested in Bristol University wind tunnel; configuration refined by Steve Fiddes at Bristol, 1994; load analysis by Duncan Gibson. Funding assistance by UK Department of Trade and Industry 'Smart Awards' from 1993, including GBP116,133 in 2000 to complete prototype.
First flight at Membury on 5 June 2003; initially operated under 'B' Conditions as G-61-2; reregistered G-CDBC in August 2004; certification programme nearing completion by mid-2006, when exhibited at Aero Expo, High Wycombe, UK.
Plans for kit version and for assembly at local centres had been abandoned by mid-2006; available only as flyaway aircraft from Membury. Certified as VLA.
CUSTOMERS: Orders taken from mid-2006 onwards.
COSTS: GBP115,000 flyaway, including radio, GPS and standard instruments.
DESIGN FEATURES: Intended for initial marketing to JAR-VLA as two-seater, but engineered from the outset for ease of upgrading to four-seat FAR Pt 23 and equivalents. Low-drag design; believed first to achieve 3.88 km/h/kW (1.56 kt/hp) at continuous cruising power.
Mid/low-wing configuration; marked anhedral on tapered outer wing panels; low tailplane and sweptback fin, L/D ratio 21. Roomy cockpit with semi-reclining seats. Wings removable for storage; requires two persons to (dis)assemble.
Laminar flow wing section.
FLYING CONTROLS: Manual. Ailerons, rudder and all-moving tailplane with anti-balance tab. Aileron and tailplane actuation by pushrods; rudder by cables. Fowler flaps; max deflection 30°; +12° reflex setting of rearmost one-third for low-drag cruising; electrical actuation by torsion drive through control gearbox and rack-and-pinion drive.
STRUCTURE: Prototype constructed from epoxy composites, post-cured in heated moulds; extensive use of carbon fibre and PVC sandwich panels in wings; fuselage of glass fibre outer skin and sandwich core; wings of glass/carbon sandwich skins, with carbon-capped

I-beam main spar and rear flap spar; and sailplane-type spar extensions and spherical wing shear pins. Production version has fuselage entirely of carbon fibre and wings similar, except for ribs and spar webs. Rollover protection beam for cockpit.
LANDING GEAR: Tricycle type; retractable. Composites trailing-link main legs; steerable nosewheel. Mainwheels retract inward; nosewheel rearward. Polymer shock-absorbers on mainwheels; oleo-pneumatic on nosewheel leg. Electro-hydraulic gear actuation with free-fall emergency deployment. TOST wheels with hydraulic brakes. Mainwheels 6.00-5; nosewheel 5.00-5.
POWER PLANT: One 84.6 kW (113.4 hp) Rotax 914F liquid-cooled, turbocharged flat-four driving an MT-Propeller MTV-7-A/17C-112 three-blade, constant-speed (electric) propeller. Fuel in two wing tanks; combined capacity 200 litres (52.8 US gallons; 44.0 Imp gallons). Fuel system optimised for mogas.
ACCOMMODATION: Two persons in semi-reclining seats, side by side beneath individual, left and right forward-hinged Plexiglas transparencies framed in carbon fibre. Instrument panel is integral with canopy. Large baggage shelf to rear of seats. Accommodation heated and ventilated.
AVIONICS: Comms: Bendix/King KY 96A transceiver, KY 76A transponder.
Instrumentation: AvMap GPS display.
DIMENSIONS, EXTERNAL:
Wing span 9.70 m (31 ft 10 in)
Wing aspect ratio 7.8
Length overall 7.49 m (24 ft 7 in)
Height overall 2.50 m (8 ft 2½ in)



Aviation Enterprises Magnum prototype at its first public air show: Aero Expo, High Wycombe, June 2006 (Paul Jackson)

1158130

Wheelbase	1.74 m (5 ft 8½ in)
Wheel track	1.65 m (5 ft 5 in)
Propeller diameter	1.70 m (5 ft 7 in)
DIMENSIONS, INTERNAL:	
Cockpit max width	1.22 m (4 ft 0 in)
AREAS:	
Wings, gross	11.88 m ² (127.9 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	500 kg (1,102 lb)
Max baggage weight	50 kg (110 lb)
Max T-O weight	750 kg (1,653 lb)
Max wing loading	63.0 kg/m ² (12.91 lb/sq ft)
Max power loading	8.87 kg/kW (14.58 lb/hp)

PERFORMANCE:	
Never-exceed speed (VNE)	180 kt (333 km/h; 207 mph)
Cruising speed at 75% power	137 kt (254 km/h; 158 mph)
Econ cruising speed at 38% power	115 kt (213 km/h; 132 mph)
Stalling speed: clean	48 kt (89 km/h; 56 mph)
flaps and gear down	40 kt (75 km/h; 46 mph)
Max rate of climb at S/L	289 m (950 ft)/min
T-O run	300 m (985 ft)
T-O to 15 m (50 ft)	450 m (1,480 ft)
Landing from 15 m (50 ft)	350 m (1,150 ft)
Landing run	250 m (820 ft)
Service ceiling	4,875 m (16,000 ft)
Range: at 75% power	1,370 n miles (2,537 km; 1,576 miles)
at 38% power	2,200 n miles (4,074 km; 2,531 miles)

BAE

BAE SYSTEMS PLC

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 CHAIRMAN: Richard Oliver
 CEO: Mike Turner
 MARKETING DIRECTOR: Mike Rouse
 DIRECTOR, CORPORATE COMMUNICATIONS: Hugh Colver

BAE Systems was established on 30 November 1999, upon the merger of British Aerospace (BAe) and the Marconi Electronic Systems business, then part of GEC-Marconi.
 Sales in 2005 totalled GBP15.4 billion; order book at 31 December 2005 was GBP59.8 billion (including joint ventures). Employees in 2006 totalled 90,000 located in UK, USA, Sweden, Saudi Arabia, France, Italy, Germany, Australia and Canada.
 Design and manufacturing of new aircraft (including UAVs) is undertaken by Air Systems Group.

Air Systems Group

MANAGING DIRECTOR: Nigel Whitehead

Group formed January 2002 to manage BAE Systems' activities in Hawk, Nimrod, Eurofighter Typhoon and Lockheed Martin F-35 JSF programmes. Personnel total 10,500. Nimrod structural upgrades are undertaken at the Woodford plant. New Business team involved with development of UAVs and RAF's Future Offensive Air System studies.

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BAE SYSTEMS HAWK 50, 60 and 100 SERIES

RAF/FAA designations: Hawk T. Mks 1 and 1A; Hawk Mk 128

US Navy designation: T-45A and T-45C Goshawk

Canadian Forces designation: CT-155

TYPE: Advanced jet trainer/light attack jet.

PROGRAMME: HS P1182 Hawk first flew 21 August 1974; first-generation Hawk no longer produced; current manufacture is of advanced 100 Series; single-seat 200 Series also out of production. Hawk design leadership transferred from Kingston to Brough 1988, and final assembly and flight test from Dunsfold to Warton 1989; Warton assembly line officially



Production Denel/BAE Systems Hawk Mk 120 of SAAF (Jane's/Patrick Allen) 1196330

opened 24 October 1991; Brough subsequently assumed responsibility for final assembly, although first flights still at Warton.

Hawk 50 Series main exports made December 1980 to October 1985; largely supplanted by 60 Series until final aircraft in 1997; Hawk 100 enhanced ground attack export version announced mid-1982; first flight of 100 Series aerodynamic prototype (G-HAWK/ZA101 converted as Mk 100 demonstrator) 21 October 1987; trials of wingtip Sidewinder rails started at Warton in April 1990.

RAF ceremonially flew its 1,000,000th Hawk hour 5 July 2006.

CURRENT VERSIONS: **Hawk T. Mk 1:** Two-seater for RAF advanced flying and weapon training; 23.1 kN (5,200 lb st) Adour 151-01 (-02 in Red Arrows aircraft) non-afterburning turbofan; two dry underwing hardpoints; underbelly 30 mm gun pack; three-position flaps; simple weapon sight in some aircraft of No. 4 FTS.

Hawk T. Mk 1A: Contract January 1983 to wire 89 Hawks (including Red Arrows) for AIM-9L Sidewinder on each inboard wing pylon and optional activation of previously unused outer wing hardpoints; last conversion redelivered 30 May 1986.

RAF Hawk re-wing programme began 1989; initial 85 wings completed by BAe in 1993; delivery of second batch of 59 began November 1993 and completed in 1995. Rebuild programme by BAe for 80 RAF Hawks authorised 27 December 1998 to replace centre and rear fuselage by Mk 65 standard structures, extending service life to 2010; work undertaken at DARA St Athan and BAE Systems at Brough; first aircraft, XX348, redelivered 11 April 2000; last was XX242, delivered to Red Arrows on 27 August 2003. Aircraft comprised 11 Mk 1s, 62 Mk 1As and seven Mk 1Ws, retaining original designations. (Sole external indication of this upgrade is displacement of rear strobe light from centreline.) Avionics upgrade plans being formulated in Staff Requirement (Air) 449; primary aim is 'glass cockpit'. In 2006, UK MoD fleet included 132 Hawks.

In total, life extensions increased RAF Hawk lives from 6,000 to 10,200 hours and fatigue index from 100 to 150.

Hawk T. Mk 1W: Following re-winged, 24 RAF Hawk T. Mk 1s gained the ability to carry stores on two underwing pylons, although not the centreline gun pod. The alternative designation **T. Mk 1FTS** is also used for this modification.

Hawk 50 Series: Initial export version with 23.1 kN (5,200 lb st) Adour 851 turbofan.

T-45 Goshawk: US Navy version; built by Boeing. *Described separately.*

Hawk 60 Series: Development of 50 Series with 25.4 kN (5,700 lb st) Adour 861 turbofan; leading-edge devices and four-position flaps to improve lift capability.

Hawk 100 Series: Enhanced ground attack development of 60 Series, announced mid-1982, to exploit Hawk's stores carrying capability; two-seater, with perhaps pilot only on combat missions; 26.0 kN (5,845 lb st) Adour Mk 871 turbofan; new combat wing incorporating fixed leading-edge droop for increased lift and manoeuvrability from M0.3 to M0.7; full-width flap vanes; manually selected combat flaps; detail changes to wing dressing; structural provision for wingtip missile pylons; MIL-STD-1553B databus; advanced Smiths Industries HUDWAC and new air data sensor package with optional laser



First BAE Systems Hawk Mk 129 handed over to Bahrain (Jane's/Patrick Allen)

1183713

ranging and FLIR in extended nose; improved weapons management system allowing preselection in flight and display of weapon status; manual or automatic weapon release; passive radar warning; HOTAS controls; full-colour multipurpose CRT display in each cockpit; provision for ECM pod.

Demonstrator ZA101. Production prototype Mk 102D (ZJ100) flown 29 February 1992. Early orders from Abu Dhabi (placed 1989), Indonesia (signed June 1993), Malaysia (signed 10 December 1990) and Oman (signed 30 July 1990). FLIR, laser ranger and Sky Guardian RWR in Omani aircraft.

Selected by Australia in November 1996 as next-generation lead-in fighter trainer; order signed 24 June 1997 for 33 aircraft; Australian Hawk Mk 127s have new, advanced instrumentation resembling that of the F-18 Hornet and including an integrated Smiths system of three 127 mm (5 in) square colour screens in each cockpit, HUD, upgraded mission computer, engine life computer and stores management system.

Hawk LIFT: Variant of Series 100 as lead-in fighter trainer (LIFT). Features include 'combat wing', Adour Mk 871 or Mk 951 engine, new three MFD 'glass cockpit' with NVG compatibility, MIL-STD-1553B digital databus, revised mission planning system/data transfer unit, INS/GPS, OBOGS, APU, HUMS, new HUD and HOTAS controls. Provision for FLIR and aerial refuelling. Initial customer is South Africa (Mk 120); first SAAF Hawk (and sole aircraft assembled in UK) first flew (ZJ970, later SAAF 250) 2 October 2003; delivered to South Africa inside Antonov An-22 17 October 2003. First assembled by Denel at Johannesburg made initial flight (251) 13 January 2005.

Offered to RAF (Mk 128) to meet MFTS (military flying training system) requirement for some 31 to enter service in 2007 as lead-in to Eurofighter Typhoon, having open-architecture avionics and Adour Mk 951 engines. Maximum weapon load 3,000 kg (6,614 lb); basic mass empty 4,480 kg (9,877 lb). On 30 July 2003, BAE announced formal RAF commitment to potential £800 million contract for 20 Mk 128s, and 24 options; design and development contract, worth £159 million, signed 22 December 2004, covering only two development aircraft. First flight (ZK010) 27 July 2005; second aircraft (ZK011) flew 6 March 2006. Contract for 26 aircraft (not including earlier two) signed 19 October 2006, although 35 RAF serial numbers reserved in December 2004. Ascent consortium (Lockheed Martin and VT Group) named preferred bidder on 30 November 2006 for 25-year contract valued at GBP600 million (not including cost of aircraft); service entry target then April 2007 for ground training and full service provision by 2012.

Hawk 200 Series: single-seat multirole version. *Described separately.*

Hawk 100HND: Hawk New Development Aircraft; based on Mk 127. Prototype, and testbed for Adour Mk 951 turbofan, first flew (ZJ951) at Warton 5 August 2002 (initially with interim standard engine). To Bredasdorp, South Africa, for further trials associated with SAAF Hawk Mk 120; first flew with Mk 951 engine in May 2003.

CUSTOMERS: Refer to table. BAE delivered 20 Hawks in 1996 and 22 in 1997; none in 1998; deliveries resumed in 1999 with 10 to Indonesia before supply of remaining six was suspended by UK government embargo of 11 September 1999; deliveries re-authorised in early 2000, but without certain US-sourced components. Deliveries in 2000 totalled 16 (eight Australian and eight Canadian), not including Australian assembly. In 2001, UK production line delivered 13 (three to Australia and 10 to Canada); 2002 production comprised two to Canada and one company trials aircraft; 2003 production totalled one for South Africa. Two for Canada in 2004. One for RAF and two for Bahrain in 2005.

First Australian Hawk (A27-01) flew (in UK, temporarily as ZJ632) on 16 December 1999. First Australian-assembled aircraft flew (A27-010) on 12 May 2000; final Australian production delivery 8 August 2001; last UK-built aircraft delivered 5 October 2001.

BAE, Bombardier and partners T-6A Harvard II and Hawk Mk 115 as equipment of Canadian-based NATO Flying Training in Canada (NFTC) programme; contract agreed 17 November 1997 and formally issued on 12 May 1998 for 18, plus eight options, two of latter being taken up in 1999; further two stated to be required in early 2000, after Singapore joined programme; order total increased to 22 by early 2002. First aircraft, 155201, arrived in Canada 4 July 2000; officially received 6 July; instructor training began 12 July 2000. First flight of 22nd Hawk on 29 June 2004.

Hawk LIFT selected for purchase by South Africa, as announced 18 November 1998; order for 12, plus 12 options, announced 15 September 1999 and signed 3 December 1999; these first Hawks with Adour Mk 951 engines. First two handed over to SAAF 24 May 2006; formal acceptance of first 10 (and formation of 85 CFS) 19 October 2006.

Bahrain announced selection of Hawk on 22 July 2002; contract signed 28 January 2003; Mk 129 based on Mk 127, but with Adour Mk 951 engine; six aircraft, plus six options; part of training programme also including Slingsby Firefly piston lightplanes. First flew on 26 August 2005, temporarily as ZK106; last aircraft flew 24 October 2006. Initial acceptance (in UK) 30 June 2006; public handover at Farnborough, 17 July 2006; departed UK 13 October 2006.

India requested quotation in September 1999 for 92 Hawks, later amended to 66, of which eight kits and 42 complete aircraft to be assembled by HAL at Bangalore; Anglo-Indian political reaffirmation of purchase plans on 12 December 2000; purchase agreement announced 3 September 2003 for 24 UK-built Hawks (temporarily ZK121 onwards) and 42 assembled in India; designation Mk 132. ZK121 first flew at Warton 13 December 2006. Avionics tested in company demonstrator ZJ100, 2006. Indian Navy expressed interest in 16 Hawks in mid-2006.

COSTS: South African purchase of 24 Hawk LIFTs estimated at R4.7 billion (1998). Canadian contract for 20 valued at GBP400 million (1999). Hawk centre/rear fuselage replacement for 80 RAF aircraft valued at GBP100+ million (2000). RAF Mk 128 purchase GBP160 million for design, development and production of initial two (2004) plus 26, costing GBP450 million, in 2006.

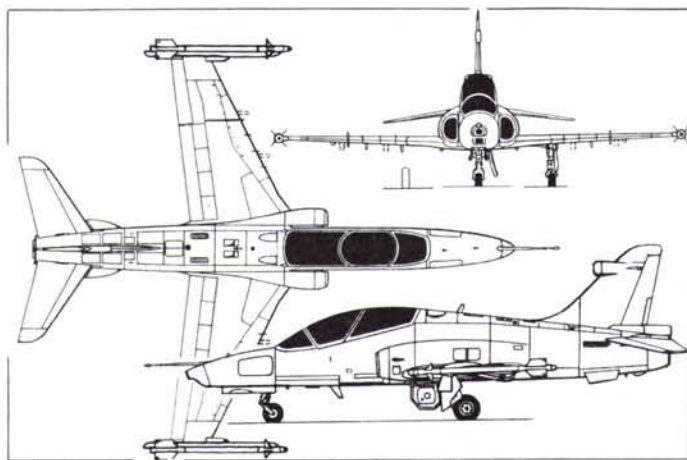
DESIGN FEATURES: Fully aerobatic two-seat advanced jet trainer, adaptable for ground attack and air defence; design capable of other optional roles, with wing improvements on developed Series to enhance combat efficiency. Low wing and mid-mounted, anhedral, sweptback tailplane; air intake on each side of fuselage, forward of wing leading-edge; single non-afterburning engine; elevated rear cockpit to enhance forward view; two strakes below rear fuselage; smurfs (refer Hawk 200 entry) on 100 Series; optional underwing hardpoints; wingtip AAM rails (100 Series).

Wing thickness/chord ratio 10.9 per cent at root, 9 per cent at tip; dihedral 2°; sweepback 26° on leading-edge, 21° 30' at quarter-chord.



First BAE Systems Hawk Mk 128 destined for RAF (Paul Jackson)

1158857



BAE Systems Hawk 100 with wingtip Sidewinders (Dennis Punnett)

1158774

FLYING CONTROLS: Conventional and assisted. Ailerons and one-piece all-moving tailplane actuated hydraulically by tandem actuators; rudder manually actuated, with electric trim tab. Hydraulically actuated double-slotted flaps, outboard 300 mm (12 in) of flap vanes normally deleted; small fence on each wing leading-edge; 100 and 200 Series use special 'combat wing' with full-width flap vanes (refer Hawk 200 entry); large airbrake under rear fuselage, aft of wings. Hydraulic yaw damper on 100 Series rudder.

STRUCTURE: Aluminium alloy; one-piece wing, with machined torsion box of two main spars, auxiliary spar, ribs and skins with integral stringers; most of box forms integral fuel tank; honeycomb-filled ailerons; composites wing fences; frames and stringers fuselage. Wing attached to fuselage by six bolts.

LANDING GEAR: Wide-track, hydraulically retractable tricycle type, with single wheel on each unit. AP Precision Hydraulics oleos and jacks. Main units retract inward into wing, ahead of front spar; castoring (optionally power-steered) nosewheel retracts forward. Dunlop mainwheels, brakes and tyres size 6.50-10 (14 ply) tubeless, pressure 9.86 bar (143 lb/sq in). (Hawk Srs 60 and 100 mainwheel pressure 17.23 bar; 250 lb/sq in at 9,100 kg; 20,061 lb T-O weight.) Nosewheel and tyre size 16x4.4 (8 ply) tubeless, pressure 8.27 bar (120 lb/sq in). Tail bumper fairing under rear fuselage, anti-skid wheel brakes. Tail braking parachute, diameter 2.64 m (8 ft 8 in), on Mk 52/53 and all 60 and 100 Series aircraft.

POWER PLANT: One Rolls-Royce Turbomeca Adour non-afterburning turbofan, as described under Current Versions. Adour Mk 861A for Switzerland assembled locally by Sulzer Brothers. Adour Mk 951, available for new-build Hawks rated at 28.9 kN (6,500 lb st) and has doubled TBO of 4,000 hours. Engine starting by Microturbo integral gas-turbine starter. Fuel in one fuselage bag tank of 832 litres (220 US gallons; 183 Imp gallons) capacity and integral wing tank of 823 litres (217 US gallons; 181 Imp gallons); total fuel capacity 1,655 litres (437 US gallons; 364 Imp gallons). Pressure refuelling point near front of port engine air intake trunk; gravity point on top of fuselage. Provision for carrying one 455 or 591 litre (120 or 156 US gallon; 100 or 130 Imp gallon) drop tank on each inboard underwing pylon, according to Series. All new Hawks since Mk 120 have provision for centreline external fuel tank and refuelling probe.

ACCOMMODATION: Crew of two in tandem under one-piece, fully transparent, acrylic canopy, opening sideways to starboard. Fixed front windscreen able to withstand a 0.9 kg (2 lb) bird at 454 kt (841 km/h; 523 mph). Improved front windscreen fitted retrospectively to RAF Hawks, able to withstand a 1 kg (2.2 lb) bird at 528 kt (978 km/h; 607 mph); this installed on all current export aircraft. Separate internal screen in front of rear cockpit. Rear seat elevated. Martin-Baker Mk 10LH zero/zero rocket-assisted ejection seats, with MDC (miniature detonating cord) system to break canopy before seats eject. MDC can also be operated from outside the cockpit for ground rescue. Dual controls standard. Entire accommodation pressurised, heated and air conditioned.

SYSTEMS: BAE Systems cockpit air conditioning and pressurisation systems, using engine bleed air. Two hydraulic systems; flow rate: System 1, 36.4 litres (9.6 US gallons; 8.0 Imp gallons)/min; System 2, 22.7 litres (6.0 US gallons; 5.0 Imp gallons)/min. Systems pressure 207 bar (3,000 lb/sq in). System 1 for actuation of control jacks, flaps, airbrake, landing gear and anti-skid wheel brakes. Compressed nitrogen accumulators provide emergency power for flaps and landing gear at pressure of 2.75 to 5.50 bar (40 to 80 lb/sq in). System 2 dedicated to powering flying controls. Hydraulic accumulator for emergency operation of wheel brakes. Pop-up Hamilton Sundstrand ram air turbine in upper rear fuselage is an option to provide emergency hydraulic power for flying controls in event of engine or No. 2 pump failure. No pneumatic system.

DC electrical power from single 12 kW 30 V DC brushless generator, with two 3 kVA 115/26 V 400 Hz three-phase inverters to provide AC power and two batteries for up to 20 minutes of standby power. Gaseous oxygen system for crew; optional Hamilton Sundstrand (HS Marston) OBOGS first installed in Australian Hawk Mk 127s from 2000 and is standard on all subsequent aircraft.

AVIONICS: *Comms:* Mk 1/Srs 50 includes Sylvania UHF and VHF; Cossor 2720 Mk 10A IFF in Finnish aircraft; Srs 60 has Rockwell Collins UHF and VHF, Magnavox UHF and Raytheon 2720 IFF; Srs 100 has Rockwell Collins AN/ARC-182 U/VHF, Magnavox AN/ARC-164 UHF and Raytheon 4720 IFF. Australian Mk 127 has twin Rockwell Collins AN/ARC-210 UHF/VHF and Raytheon 4720 IFF.

Flight: Mk 1/Srs 50 with Raytheon CAT 7000 Tacan, Cossor ILS having CILS.75/76 localiser/glide slope receiver and marker receiver; Rockwell Collins VOR/ILS and ADF, Rockwell Collins Tacan, Smiths-Newmark 6000-05 AHSR and Smiths radar altimeter in Srs 60; Srs 100 has BAE Systems INS300 inertial platform, Rockwell Collins AN/ARC-118 Tacan, Rockwell Collins VIR-31A VOR/ILS and Smiths 0103-KTX-1 radar altimeter, all integrated via dual redundant MIL-STD-1553B databus. Optional Skyforce Skymap II GPS-driven moving map in some RAF Hawks.

Instrumentation: Smiths-Newmark compass, BAE Systems gyros and inverter, two Honeywell RAI-4.4 in (100 mm) remote attitude indicators and magnetic detector system in Mk 1/Srs 50; Smiths 1500 Series HUDWAC in Srs 100; BAE Systems F.195 weapon sight in approximately 90 RAF aircraft; BAE ISIS 195 sight in Srs 50 and Srs 60, except Saab RGS2 in Finnish Mk 51.

Mission: BAE Systems camera and recorder in F.195-equipped RAF aircraft (requirement announced December 1997 to re-equip 41 with video recorders by late 1999). Vinten camera and recorder in Srs 50 and Srs 60. Srs 100 has Smiths 3000 Series colour MFD, GEC data transfer system and Vinten colour video recording system; plus BAE Systems Type 105H laser range-finder; optional FLIR.

BAE SYSTEMS HAWK CUSTOMERS

Customer	Qty	Mark	First aircraft	Deliveries	Squadrons
Abu Dhabi	16	63	1001	Oct 1984 — May 1985	
	18	102 ¹	1051	Apr 1993 — Mar 1994	Khalif bin Zayed Air College
	4	63C	1017	Feb 1995 — Mar 1995	
Australia	33 ²	127	A27-01	Apr 2000 — Oct 2001	76, 79
Bahrain	6	129	ZK106	Oct 2006 —	
Canada	22	115/CT-155	155201	Jul 2000-2004	419
Dubai	8	61	501	Mar 1983 — Sep 1983	III Shaheen
	1	61	509	Jun 1988	III Shaheen
Finland	50	51	HW301	Dec 1980 — Oct 1985	3/11, 3/21, 3/31,
	7	51A	HW351	Nov 1993 — Sep 1994	Koulutuslentolaivue, 2/Tukilentolaivue
India	24 ³	132	A3480	2007	
	42 ¹⁶	132			
Indonesia	20	53	LL-5301	Sep 1980 — Mar 1984	103
	8	109	TT-1201	May 1996 — Mar 1997	1, 12
	16	209	TT-1205	Feb 1996 — Mar 1997	12
	16	209	TT-0217	Apr 1999 —	1
Kenya	12	52	1001	Apr 1980 — May 1982	(Laikipia AB)
Korea, South	20	67	67-496	Sep 1992 — Aug 1993	216
Kuwait	12	64	140	Nov 1985 — Sep 1986	12
Malaysia	10	108 ⁴	M40-01	Jan 1994 — Sep 1995	3 FTC (15 Sqdn)
	18	208 ⁵	M40-21	Aug 1994 — May 1995	6, 9, 3 FTC (15 Sqdn)
Oman	4	103 ⁶	101	Dec 1993 — Jan 1994	6
	12	203 ⁷	121	Dec 1994 — May 1995	6
Saudi Arabia	30	65	2110	Aug 1987 — Oct 1988	21, 37
	20	65A	7901	Mar 1997 — Dec 1997	79
South Africa	12	120/LIFT ⁸	250 ¹	May 2006 —	85 CFS
Switzerland	20 ⁴	66	U-1251	Nov 1989 — Nov 1991	Nil. Withdrawn from service 2002
UK	176	T. Mk 1	XX154	Nov 1976 — Feb 1982	4 FTS (19 & 208 Sqdns), Red Arrows, 100 Sqdn, FSATO, QinetiQ
	30 ¹⁷	128	ZK010	2008	—
USA	211 ⁵	T-45A/C	162787	Apr 1988 —	VT-7, VT-21, VT-22
Zimbabwe	8	60	600	Jul 1982 — Oct 1982	2
	5	60A	608	Jun 1992 — Sep 1992	2
Demonstrator	3	60/102D/102NDA	G-HAWK		—
	3	200/200/200RDA	ZG200		—
Total	897				

¹ Built at Brough, Hamble and Samlesbury, assembled at Warton or Brough and first flown at Warton; unless stated otherwise, remainder built at Kingston, assembled at Dunsfold (290) and Bitteswell (1)

² Laser nose

³ 46 assembled by Valmet in Finland

⁴ 19 assembled by F + W in Switzerland

⁵ Production by Boeing in USA (see International section)

⁶ Two first flown at Warton

⁷ Wingtip Sidewinders

⁸ 89 converted to T. Mk 1A

⁹ 13 converted to 63A; two to 63B

¹⁰ Removable refuelling probe

¹¹ Radar warning receiver

¹² First 12 assembled at Warton; remainder by BAe Australia at Williamtown, assisted by Hunter Aerospace, Hawker de Havilland and Qantas

¹³ One first flown at Warton

¹⁴ Five repurchased by BAE Systems in 1999

¹⁵ Plus 12 options; all except first aircraft assembled in South Africa

¹⁶ Assembled by HAL in India

¹⁷ Two demonstrators and 28 production, although 35 serial numbers initially assigned

Self-defence: (Series 100 only) Rascal Prophet RWR in Mk 102s of Abu Dhabi; BAE Systems Sky Guardian in Indonesian, Malaysian and Omani aircraft, and retrofitted to Abu Dhabi's Mk 63s; optional chaff/flare dispenser at base of fin.

ARMAMENT: Underfuselage centreline-mounted 30 mm BAE Systems Aden Mk 4 cannon with 120 rounds (VKT 12.7 mm machine gun beneath Finnish aircraft), and two or four hardpoints under wing, according to Series. Provision for pylon in place of ventral gun pack. In RAF training roles, normal maximum external load is about 680 kg (1,500 lb), but the uprated Hawk 60 and 100 Series are cleared for an external load of 3,000 kg (6,614 lb), or 500 kg (1,102 lb) at 8 g. Typical weapon loadings on 60 Series include 30 mm or 12.7 mm centreline gun pod and four packs each containing eighteen 68 mm rockets; centreline reconnaissance pod and four packs each containing twelve 81 mm rockets; five 1,000 lb free-fall or retarded bombs; four launchers each containing four 100 mm rockets; nine 250 lb or 250 kg bombs; thirty-six 80 lb runway denial or tactical attack bombs; five 600 lb cluster bombs; four Sidewinder or two Magic air-to-air missiles; or four CBLS 100/200 carriers, each containing four practice bombs and four rockets. Vinten reconnaissance pod available for centre pylon. Similar options on 100 Series, plus wingtip air-to-air missiles. Mk 102s of Abu Dhabi/UAEAF can carry (but not designate for) two Alenia Marconi PGM-500 ASMs.

DIMENSIONS, EXTERNAL:	
Wing span: Mk 1, Srs 50, Srs 60	9.39 m (30 ft 9¾ in)
Srs 100	9.08 m (29 ft 9½ in)
Srs 100 with Sidewinders	9.94 m (32 ft 7⅞ in)
Wing chord: at root	2.65 m (8 ft 8¼ in)
at tip	0.90 m (2 ft 11½ in)
Wing aspect ratio: Mk 1, Srs 50, Srs 60	5.3
Srs 100	4.9
Length: fuselage (incl jetpipe):	
Mk 1, Srs 50, Mk 60-66	10.775 m (35 ft 4¼ in)
Mk 67	11.375 m (37 ft 3¼ in)
Srs 100	11.40 m (37 ft 4¼ in)
fuselage and pitot:	
Mk 1, Srs 50, Mk 60-66	11.455 m (37 ft 7 in)
Mk 67, Srs 100 (non combat)	12.035 m (39 ft 5¾ in)

Srs 100 (incl chaff/flare dispenser)	12.095 m (39 ft 8 in)
overall:	
Mk 1, Srs 50, Mk 60-66	11.845 m (38 ft 10¼ in)
Mk 67, Srs 100	12.425 m (40 ft 9¼ in)
Nose to pitot tip:	
Mk 1, Srs 50, Mk 60-66	0.68 m (2 ft 2¾ in)
Mk 67	0.66 m (2 ft 2 in)
Srs 100	0.635 m (2 ft 1 in)
Tailplane overhang	0.39 m (1 ft 3½ in)
Height overall	3.98 m (13 ft 0¾ in)
Tailplane span	4.39 m (14 ft 4¾ in)
Wheel track	3.47 m (11 ft 5 in)
Wheelbase	4.50 m (14 ft 9 in)
AREAS:	
Wings, gross	16.69 m² (179.6 sq ft)
Ailerons (total):	
Mk 1, 50 and 60 Series	1.05 m² (11.30 sq ft)
100 Series	0.97 m² (10.44 sq ft)
Trailing-edge flaps (total)	2.50 m² (26.91 sq ft)
Airbrake	0.53 m² (5.70 sq ft)
Fin: Mk 1, 50 and 60 Series	2.51 m² (27.02 sq ft)
100 Series	2.61 m² (28.10 sq ft)
Rudder, incl tab	0.58 m² (6.24 sq ft)
Tailplane	4.33 m² (46.61 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty: 60 Series	4,012 kg (8,845 lb)
100 Series	4,400 kg (9,700 lb)
Max weapon load (60, 100 Series)	3,000 kg (6,614 lb)
Max usable fuel weight:	
internal	1,277 kg (2,815 lb)
external	930 kg (2,050 lb)

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Specially decorated Hawk T. Mk 1s of No. 4 FTS, RAF (Jamie Hunter)

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Max T-O weight: T. Mk 1	5,700 kg (12,566 lb)	100 Series	640 m (2,100 ft)
50 Series	7,350 kg (16,200 lb)	Landing run (10% fuel load): 60 Series	550 m (1,800 ft)
60, 100 Series	9,100 kg (20,061 lb)	100 Series	605 m (1,980 ft)
Max landing weight: T. Mk 1	4,649 kg (10,250 lb)	Combat radius, Aden gun pod and two Sidewinder AAMs:	
60 Series	7,650 kg (16,865 lb)	with four 500 lb bombs and two 130 Imp gallon tanks	345 n miles (638 km; 397 miles)
Max wing loading: T. Mk 1	341.5 kg/m ² (69.97 lb/sq ft)	with four 1,000 lb bombs	125 n miles (231 km; 143 miles)
50 Series	440.4 kg/m ² (90.20 lb/sq ft)	Ferry range:	
60, 100 Series	545.4 kg/m ² (111.70 lb/sq ft)	60 Series, with two 591 litre (156 US gallon; 130 Imp gallon) drop tanks	1,575 n miles (2,917 km; 1,812 miles)
Max power loading: T. Mk 1	246 kg/kN (2.42 lb/lb st)	100 Series, as above	1,360 n miles (2,519 km; 1,565 miles)
50 Series	318 kg/kN (3.12 lb/lb st)	Endurance, 100 n miles (185 km; 115 miles) from base:	
60 Series	359 kg/kN (3.52 lb/lb st)	60 Series	approx 2 h 42 min
100 Series	350 kg/kN (3.43 lb/lb st)	100 Series	approx 2 h 6 min
PERFORMANCE:		g limits: full internal fuel, all	+8/-4
Never-exceed speed (VNE), clean:		100 series, 60% fuel load:	
at S/L	M0.87 (575 kt; 1,065 km/h; 661 mph EAS)	1,360 kg (3,000 lb) external load	+8/-4
at and above 5,180 m (17,000 ft)	M1.2 (575 kt; 1,065 km/h; 661 mph EAS)	2,721 kg (6,000 lb) external load	+6/-3
Max level speed at S/L:			
50 Series	535 kt (990 km/h; 615 mph)		
60 Series	545 kt (1,010 km/h; 627 mph)		
100 Series	540 kt (1,001 km/h; 622 mph)		
Max level flight Mach No.	0.88		
Stalling speed, flaps down	96 kt (177 km/h; 110 mph)		
Max rate of climb at S/L	3,600 m (11,800 ft)/min		
Time to 9,150 m (30,000 ft), clean: 60 Series	6 min 54 s		
100 Series	7 min 30 s		
Service ceiling: 60 Series	14,020 m (46,000 ft)		
100 Series	13,565 m (44,500 ft)		
T-O run (clean): 60 Series	710 m (2,330 ft)		

BAE SYSTEMS NIMROD MRA. Mk 4

TYPE: Maritime reconnaissance four-jet.
PROGRAMME: Original Hawker Siddeley HS 801 Nimrod first flew 23 May 1967 as adaptation of de Havilland D.H.106 Comet airliner. Total of two prototypes (converted Comet fuselages; now withdrawn), 46 Nimrod MR. Mk 1s and three Nimrod R. Mk 1 elint/sigint aircraft built for the RAF. Of these, 35 converted to MR. Mk 2 from 1979 onwards and 11 became Nimrod AEW. Mk 3s, but failed to enter service and were scrapped. MR. Mk 2 fleet of Nos. 42(R), 120, 201 and 206 Squadrons at Kinloss in 1996 totalled 28 (including three



BAE Systems Nimrod MRA. Mk 4 ZJ517 making the type's first public appearance over Farnborough on 18 July 2006 (Jane's/Patrick Allen)

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in long-term storage), plus one under conversion to R. Mk 1, four scrapped or used for ground instruction and two lost in accidents. Force reduced to three squadrons on disbandment of No. 206 on 1 April 2005; fleet reduced to 16 Mk 2s in early 2006; last to have been replaced by Mk 4s by 2011, although Nimrod fleet may be moved from current base at Kinloss in 2013. Two original R. Mk 1s remain with No. 51 Squadron at Waddington, augmented by one conversion.

Following RAF issue of Staff Requirement (Air) 420 for a Nimrod replacement, Dassault Atlantique 3, two versions of Lockheed Martin P-3 Orion (new production from manufacturer or refurbished P-3A/Bs from Loral) and upgraded Nimrod offered as potential solutions. UK official announcement on 25 July 1996 nominated last-mentioned proposal under commercial designation (since abandoned) Nimrod 2000. Although based on existing aircraft, the upgrade involves extensive (80 per cent) reconstruction of the airframe, plus incorporation of many new components, including engines, wings, landing gear and general systems, as well as new flight deck and detection systems. Contract MAR21a/100 awarded January 1997. Initial three development batch (DB) aircraft are conversions of stored Mk 2s, on which work began in early 1997; first delivery originally scheduled to RAF in 2001, followed by IOC in April 2003 on delivery of seventh aircraft; by early 1999, these dates had slipped 23 months due, in part, to excessive weight of new wing. New schedule called for first flight in June 2002; service deliveries in August 2004; IOC in March 2005; and final delivery in December 2008. Critical design review for air vehicle conducted late 1999 and finalised in early 2000, completing weapon system design. However, due to further slippage, prototype was given media debut on 16 August 2002 in expectation of maiden flight before year-end; delivery then stated to be late 2004.

By October 2002, first flight had been rescheduled for second half of 2003 due to discovery of "minor issues during airframe stress testing", although in-service date of March 2005 stated to be unchanged. BAE Systems and MoD announced change to Nimrod contract on 19 February 2003, this including halt to structural work on fourth and subsequent aircraft until risk reduction exercise completed on first three. This formalised by agreement signed 23 February 2004. Price data for completion of 12 aircraft submitted to MoD on 13 July 2005; contract award (and first public appearance; Farnborough flypast) 18 July 2006; first delivery 2009: first squadron forms 2010; final delivery 2012.

Ground testing and verification of engineering plans undertaken at Warton on Nimrod MR. Mk 1 prototype XV147. FR Aviation at Hurn, Bourmemouth, selected for airframe relift and upgrading as subcontractor to BAE, flying 'green' aircraft to Warton for mission avionics installation; first three (DB) aircraft (XV247/PA1, XV234/PA2 and XV242/PA3, for modification in that order) dismantled at RAF Kinloss and flown to Hurn by Antonov An-124 14 to 16 February 1997; redelivery to Warton originally due late 1999, January and February 2000. Fourth conversion subject, XV251/PA4, to Hurn under own power, 2 November 1998.

Programme revised in early November 1999, when FR Aviation contract cancelled and airframe work transferred to BAE at Woodford. PA1 completed at Hurn; PA2, PA3 and PA4 airfreighted to Woodford in An-124 in November/December 1999 for completion. Fifth subject, XV258/PA5, delivered directly ex-RAF to Woodford on 8 November 1999; further two (XZ284 and XV233) followed in 2000 and one (a former ground instructional airframe, XV253) in October 2001. Wing for initial aircraft delivered from Chadderton to Woodford in September 2000; second aircraft similarly fitted in December 2000.

Short Brothers and various BAE plants supply airframe components and subassemblies. Ground training systems supplied by Thomson TSL.

Static test wing mounted on Nimrod AEW. Mk 3 fuselage for 1,000 hour trial, beginning 2004.

CURRENT VERSIONS (SPECIFIC): PA1/ZJ516: First flight 26 August 2004; landed at Warton. Aerodynamic, avionics and engine trials.

PA2/ZJ518: First flight 15 December 2004; landed at Warton. Full mission system: avionics and mission systems tests; weapon carriage and release trials. First with grey colour scheme, May 2005; Sigonella, Sicily, for environmental testing; Eglin AFB, Florida, 26 September 2006, for six weeks in McKinley climatic laboratory.

PA3/ZJ517: First flight 29 August 2005; landed at Warton. Mission systems tested. Production standard, but additional flight test instrumentation fitted.

By July 2006, combined test flight totals were 125 sorties and 320 hours. CUSTOMERS: Royal Air Force order was originally 21. In deference to comprehensiveness of rebuild, aircraft issued with new serial numbers ZJ514 to ZJ534. However, in March 2002 it was announced that the contract had been reduced to 18. Defence review of July 2004 reduced in-service fleet requirement to 12 aircraft, including three prototypes. Formal announcement of contract award made at Farnborough on 18 July 2006.

COSTS: Ordered as GBP2 billion programme, including training system and initial logistic support, of which 75 per cent of work being placed with UK companies. Boeing TCCS mission system avionics contract valued at USD639 million (1996). Programme cost increased to GBP2.4 billion by March 1999, equivalent to 0.5 per cent above inflation. In mid-2000, BAE agreed to pay GBP46 million penalty because of 23-month programme slippage. BAE profits suffered GBP300 million charge in 2000 to offset expected Nimrod contract losses. Programme cost stated in 2002 to be GBP2.98 billion. Further GBP500 million charged to BAE accounts for 2002. By March 2005, GBP2.2 billion had been spent; 2006 contract valued at under GBP1 billion; eventual cost estimated (2006) GBP3.8 billion.

DESIGN FEATURES: World's first jet-powered, land-based maritime patrol and ASW aircraft on original 1969 service-entry; remains sole four-jet in this role. Optimised for anti-submarine warfare (ASW), anti-surface unit warfare (ASUW), search and rescue (SAR), maritime reconnaissance and provision of aid to civil authorities, including fisheries protection and operations against terrorism, drug smuggling and blockade running. Combines fast transit to operational area with low wing loading (and, hence, manoeuvrability) when on station. Can cruise on two or three engines to extend endurance. No special ground equipment required for off-base deployments.

Mid-mounted wing, with two engines in each root; wingtip ESM pods; two hardpoints under each wing. Dihedral tailplane with auxiliary fins at one-third span to counter aerodynamic effects of electro-optical turret rotation; fin has large fillet and electrical equipment/decoy housing pod at tip. MAD tailboom. 'Double bubble' fuselage cross-section, with weapons bay below; latter restructured for Mk 4 and now in two, separated parts. Wing sweepback 20° at quarter-chord.

Operational life of 150,000 hours with annual A Check and six-yearly C Check. Designed for first-line mean active repair time of 29.5 minutes for light rectification and 180 minutes for heavy rectification; 4.2 mmh/th first- and second-line preventative maintenance; 60 minutes post-flight maintenance, including 30 minute refuelling. Reliability contract specifies 480 faults per 1,000 flying hours. Engine change time 3 hours; power plant reliability targets per 1,000 hours are 0.1 unscheduled removal, two fail-to-start and 0.03 in-flight shut-down.

FLYING CONTROLS: Conventional and powered. Aileron and elevator systems have release units, used to disconnect the two halves of the control circuits in the event of a jam, thus enabling control of the unjammed half of the control circuit to be retained. Secondary flight controls consist of flaps and air brakes. Flaps comprise inner and outer flap surface on each wing. Two airbrake surfaces per wing; one upper and one lower.

STRUCTURE: Conventional construction including fuselage and unpressurised panner which includes weapons bay and nose radome. Panner segments are free to move, so that structural loads are not transmitted to pressure cell. Fuselage and empennage have frames, ribs and stringers that support skin panels made of light alloy; cantilever wing has machined skins and stringers, with machined spars and tank walls. Centre fuselage designed at Prestwick and built at Brough; lower and front fuselages designed at Farnborough and built at Brough; rear fuselage designed by Dassault in France and built at Brough. Fuselage pressure hull and rear retained from original airframes, but with new bulkheads and protective treatment.

Wings have a new-design machined centre-section, built at Chadderton, that contains No. 1 fuel tank. Stub wing contains the four engines, and carries the hardpoints for weapon pylons. Stub wing also mounts main landing gear that is housed in a compartment outboard of the engines; retractable door and leg-mounted fairing seals the compartment. Outer wing (originally to have been retained, but now new-built, as requested by RAF, at Prestwick from Filton design) has both integral and pod fuel tanks and supports conventional ailerons, flaps and airbrakes. Wingtip pylons and winglets house electronic surveillance measures (ESM) and radar warning equipment.

Empennage has fixed tailplanes with aerodynamic finlets and elevators, plus rudder and fin that includes a dorsal fin and a fin-top fairing. Tailplane, elevators, rudder designed at Prestwick and Farnborough and built at Prestwick and by FR Aviation.

Fuselage pressurised from Frame 1 to Frame 54; unpressurised rear fuselage houses two environmental control system conditioning packs, flying control rods and levers. A boom contains a magnetic anomaly detector (MAD) head. Below the fuselage is a ventral fin with a bump-stop.

Unpressurised radome, forward of the nose landing-gear bay, houses radar scanner. Radome is part of a panner which provides a bay for the carriage of various stores and equipment. Panner comprises skin panels, skirt panels, bulkheads and four bomb doors. Rear fairing houses a towed radar decoy.

LANDING GEAR: Tricycle type; retractable. Four-wheel tandem main bogie units, tyre size 36x10.00-18 PR24; twin nosewheels, tyre size 30x9.00-15 PR14. Nose gear retracts rearwards; main gear outwards. When retracted, all landing gear doors are closed; when extended, main doors close and nose door stays open.

Multiplate, carbon heat pack brakes. Brake pedals apply normal braking with anti-skid protection. Rotation of the parking brake selector on the centre console applies the parking brake.

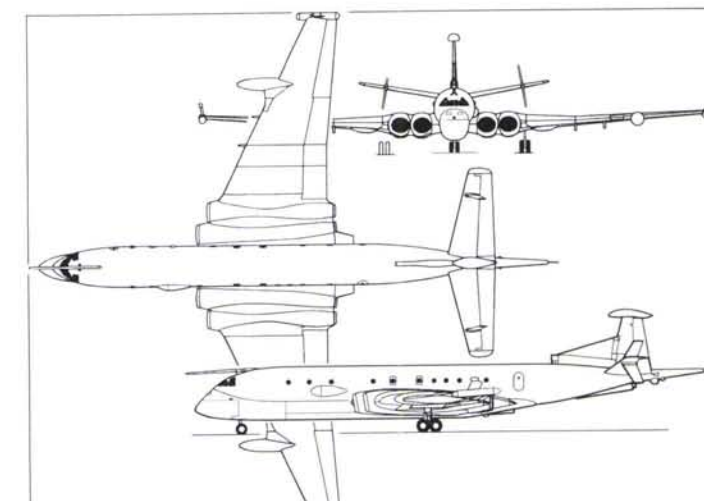
LCN "less than 75" at MTOW.

POWER PLANT: Four Rolls-Royce/BMW BR700-710 Mk 101 (BR710B3-40) high-ratio bypass, two-spool, FADEC-controlled turbofan engines in pairs, two in each wingroot, each rated at 68.9 kN (15,500 lb st). Engines alternatively can be started by ground accumulator trolley or by air from another running engine.

Fuel contained in 13 tanks in wings and fuselage and supplied to engines from one feed tank in fuselage and one in each wing. Remaining tanks transfer fuel into these feed tanks. Management by USMS computers 1 and 2, and only minimal interaction is required from aircrew. However, for certain malfunctions and for refuel, defuel, fuel dump and fuel transfer, controls are provided on the flight deck overhead panel.

All tanks are usually refuelled under pressure; Nos. 2, 3 and 4 can be gravity-filled using overwing caps. Tanks are No. 1 in wing centre-section; Nos. 2L and 2R, wings inboard; Nos. 3L and 3R, wings middle; Nos. 4L and 4R, wings outer; Nos. 4AL and 4AR, wing leading-edge pods; No. 5, fuselage, underfloor, within pressure shell, forward of wing leading edge; No. 6, fuselage, underfloor, within pressure shell, aft of wing trailing-edge; Nos. 7L and 7R (different capacities), wingroots, adjacent to No. 6. Total capacity 60,923 litres (16,095 US gallons; 13,400 Imp gallons). Usable capacities as in adjacent table.

Tank	Kg	lb	litres	US gal	Imp gal
1	8,968	19,771	11,168	2,950	2,457
2L	8,118	17,897	10,110	2,671	2,224
2R	8,118	17,897	10,110	2,671	2,224
3L	3,572	7,875	4,448	1,175	978
3R	3,572	7,875	4,448	1,175	978
4L	3,473	7,657	4,325	1,143	951
4R	3,473	7,657	4,325	1,143	951
4AL	1,497	3,300	1,864	492	410
4AR	1,497	3,300	1,864	492	410
5	2,580	5,688	3,213	849	707
6	2,620	5,776	3,263	862	718
7L	1,133	2,498	1,411	373	310
7R	300	661	374	99	82
Usable	48,921	107,852	60,923	16,095	13,400
U/U	512	1,129	638	169	140
Total	49,433	108,981	61,561	16,264	13,540



BAE Systems Nimrod MRA. Mk 4 (Paul Jackson) 1158775

ACCOMMODATION: Crew areas, front and rear, are flight deck, lavatory/forward vestibule, mission area, optional additional workstation, galley/dinette, ordnance area (containing sonobuoy racking and dispensers), rear vestibule and aft storage area. Integral airstairs.

Two-crew flight deck with supernumerary crew seat which can be located between flight crew or at worktable on starboard side. Accommodation in mission area of cabin for seven-person tactical team (Tacco 1, Tacco 2, Radar, Communications, ESM, Acoustics 1 and Acoustics 2). Lookout/photography station on port side opening blister window; ESM operator station has an observer's blister window on starboard side.

Additional nine seats for support personnel or replacement crew: four in galley/dinette; four in the ordnance area; and one in central cabin, where an optional additional workstation can be fitted.

Galley, lavatory, general lighting and cabin trim is to modern airliner standards of appearance and fire safety and is supplied by Aim Aviation. Galley fitted with oven, water boiler, refrigerator, large sink and International Water Guard NPS-A3 potable water treatment unit. All seating, by Martin-Baker, to 16 g crashworthy standard.

SYSTEMS: Four 200 V, 40 kVA, three-phase, 400 Hz integrated-drive generators, one on each engine supply electrical power. Power can also be provided from a single 200 V, 90 kVA, three-phase, 400 Hz APU generator (only while on ground) or an external power unit via a ground power socket. Each integrated-drive generator is connected to its own busbar, all of which can all be interconnected under the control of the utilities system management system (USMS). Use of a single phase of the three-phase 200 V supply provides 115 V AC power. One DC-powered 500 VA static inverter provides AC output for emergency use.

Ram air turbine (RAT), scabbled to fuselage side, ahead of port wingroot, is deployed automatically in the event of loss of all four integrated-drive generators and provides AC power solely to drive 'yellow' hydraulic system AC pump.

Environmental control system (ECS) uses air supplied by the four engines or, during ground operation, the APU. Engine bleed air is pre-conditioned by four engine bleed air conditioning packs before being distributed around the aircraft. Four conditioning packs (two in the tail and one in each wing) further condition the bleed air for use in maintaining a favourable environment for the aircrew. System is controlled by a combination of USMS and hardwired circuits. ECS provides a supply of cooling air to avionics installed in the racks and workstations.

Cabin air is drawn through equipment in 'Essential' racks using cooling fans. Equipment in 'Mission' racks is cooled in a similar fashion while on the ground; supplied with cooling air from the conditioning packs while in flight. ECS also provides a source of bleed air for airframe anti-icing, the Normalair-Garrett onboard oxygen generation system (OBOGS) and engine starting. On the ground, an external source of low pressure cooling air can be used to condition the cabin.

Cabin and flight deck pressurised to a pre-defined schedule by the cabin pressure control system. Pressurisation is maintained using the cabin and flight deck conditioning air. Control system and a dual-channel, digital cabin pressure controller, provides monitoring. Fire, smoke and overheat protection system provides detection, indication and suppression of fire in the engines and the APU; for detection and indication of smoke in avionics racks and galley area; and for detection and indication of fire in bomb bay.

GTCP 331-200(N) APU mounted in fireproof compartment in starboard wingroot. Unit consists of twin-stage centrifugal compressor section and a triple-stage axial turbine section, all on a common shaft. Provides electrical power, and bleed air for starting engines or air conditioning on ground. Not cleared for airborne operation. Digital electronic control unit (ECU) monitors and controls all aspects of APU operation.

Each flight control system has spring feel, providing increasing force proportional to inceptor displacement. In addition, elevator system has Q-feel which provides increasing force proportional to airspeed, and rudder system has limiter which progressively restricts rudder travel with increasing airspeed. Inner flaps driven by hydraulic power drive unit via shafts, gearboxes and ballscrew actuators; outer flap connected to the inner flap by a link. Flaps are normally powered by 'blue' hydraulic system, using Dowty actuators, with 'green' system as back-up. Airbrakes are driven by hydraulic actuators and powered by 'green' hydraulic system.

Automatic flight control system (AFCS) provides eight main functions to improve stability and provide guidance and/or automatic control: (1) Control in the directional (yaw) plane; rudder control surface controlled with two independently operated ganged-out yaw dampers. (2) Automatic control of longitudinal (pitch) stability; by movement of elevator control surfaces with separate pitch trim. (3) Assisted control in lateral (roll) plane; controlled by movement of ailerons. (4) Steering guidance on flight director to enable manual control in the pitch and roll planes to achieve required flight path. (5) Three-dimensional guidance and/or control of aircraft position, using external radio navigation aids and flight management system. (6) Automatic control of engine thrust to control speed and vertical path, and NI synchronisation to reduce noise and vibration interference from engines. (7) Display of AFCS operation, alerts and mode/status indications on flight deck display system. (8) Guidance for take-off and go-around, and approach for Category I (Cat I) operation. Stall warning system.

Oxygen system for crew and passengers. USMS controls operation, but oxygen can be manually selected. OBOGS is main source of breathing oxygen, supported by 1,400 litre (49.4 cu ft) back-up oxygen supply (BOS) cylinders. Oxygen also available in portable oxygen sets, for crew movement about the cabin and for emergencies.

Hydraulic system has two main subsystems; emergency and an auxiliary. Main subsystems are designated 'blue' and 'green'; auxiliary as 'yellow'. No.3 and No.4 engines drive pumps for blue system, this also having AC and DC electrical pumps.

Blue system provides power for ailerons, elevators, rudder and alternative power to landing gear; normal hydraulic power to bomb bay doors and flaps, and hydraulic power to bomb bay door secondary actuators; normal hydraulic power to wheel brakes and for operation of parking brake. Blue system supplies hydraulic power to power transfer unit (PTU) motor. Blue subsystem is powered by a DC pump and provides power to lower the landing gear and operate wheel brakes in the event of a failure of both blue and green systems.

Green system powered by EDPs on Nos.1 and 2 engines and also by PTU pump. Supplies hydraulic power to ailerons, elevators and rudder, power to operate airbrakes, nosewheel steering and landing gear; plus alternative power to bomb bay doors, flaps and brakes, if blue hydraulic system fails.

Yellow hydraulic system has an AC electric pump and supplies aileron, rudder and elevator systems in the event of both blue and green hydraulic systems failing. Yellow pump can also have power provided by the RAT in the event of total engine loss.

Powered flying control units (PFCUs) operate all primary flight control surfaces. Aileron system uses two simplex PFCUs per control surface; elevator and rudder systems each have a tandem PFCU per control surface. Hydraulic power from the blue and green hydraulic system is normally used for the PFCUs. Yellow hydraulic power is used as emergency back-up for the primary flying controls only.

Ice and rain protection system provides anti-icing for airframe and engine intakes and heating for windcreens, air data probes, pressure heads and water drain masts. Windscreen wash wipe system clears rain and other contaminants.

Utilities systems management system (USMS) integrated digital system, providing control, monitoring, test functions and health status for all general systems and also

interfaces with aircraft conditioning monitoring system (ACMS); engine management unit (EMU); navigation and flight management system (NAV/FMS); radio navigation aids; and warnings and acquisition computer (WAC)

AVIONICS: Airframe incorporates 6 million lines of software code; 90 antennas and sensors; and over 1,000 mission avionic line-replaceable items. Extensive use of off-the-shelf items.

Comms: Five V/UHF radios incorporating Have Quick II secure speech facility; two UHF radios. Thales IFF Mode S transponder. Radio communications system (RCS) controls all internal and external; includes intercom system (ICS). RCS has two radio management units (RMU) on flight deck that control two identical V/UHF systems. ICS controls all internal and external distribution of audio signals between the crew members; integrates navigation tones, warning tones and internal voice communications to flight deck and to applicable cabin workstations; provides interface between the crew members and V/UHF radio systems.

Radar: Thales Searchwater 2000MR radar integrated into the TCSS (tactical control and sensor system). Radar gives target classification using both range profiling and synthetic image processing techniques, with following modes: maritime reconnaissance; air to air; weather; swath SAR; spotlight SAR; ISAR; SAR; RN I-band Transponder; and D-band IFF interrogator.

Principal elements comprise: (1) Two-axis scanner in nose, incorporating IFF dipole aerials for interrogator operation. (2) Transmitter. (3) Radar frequency and control unit (RFCU) directing high power I-band radar pulses to the scanner. (4) Receiver extiter (RxE) unit to generate timing pulses for the system and also (at low level power) I-band radar frequency radar pulses to be transmitted by the radar. (5) Signal processor (SP) to process digitised radar (and transponder) returns; or SAR and ISAR modes. SP undertakes motion compensation and image processing. (6) Data processor (DP), receiving command and control information from TCS via MIL-STD 1553 interface; mode setup commands are then distributed to all system units; DP provides all display data to the TCSS for presentation on the radar operator's PPI display. (7) IFF interrogator. (8) IFF crypto unit, enabling cryptographic codes to be loaded into IFF. (9) INS/GPS providing radar with time, position, heading and aircraft attitude (latter enabling scanner to be stabilised against aircraft attitude changes); additionally for SAR and ISAR modes, INS/GPS unit provides high-speed motion compensation data to enable aircraft motion to be determined. (10) Radar video recorder providing recording and playback of IPAL video, using Hi-8mm videotape cassettes.

Flight: Navigation controlled through the flight management system (FMS), interfacing with AFCS, FDDS and the aircraft sensor systems. FMS has two multifunction control and display units (MCDU) controlling tuning of the radio navigation systems. Triple air data system. BAE Systems ILS/VOR/MLS. Rockwell Collins ADF, DME, Rockwell Collins Tacan, twin Litton LN-1006 laser INS with embedded GPS, Thales radar altimeters, embedded Aviation Specialities EGWPS, Rockwell Collins TCAS II.

Instrumentation: Flight deck display system (FDDS) has seven Thales display units (based on those of Airbus A330/A340) and shows flight reference data, aircraft system condition and crew alerting information. Independent instrument system has 11 stand-alone instruments (SAI), of which five provide back-up flight reference data.

Mission: Tactical command and sensor system (TCSS), integrated by Boeing, provides command and control of mission system and mission sensors, conforming to MIL-STD-1760; and capability for mission operators to manage tactical situation, control sensor, navigation, communication and defensive aids subsystems and to command stores deployment on seven identical, Boeing-supplied consoles. It uploads pre-flight message (PFM) data to all mission avionics subsystems and performs in-flight mission data recording. Additionally commands and co-ordinates built-in test (BIT) facilities on all subsystems and on TCS computing equipment itself.

Northrop Grumman Nighthunter electro-optical surveillance and detection system (EOSDS) has retractable turret, with deployment unit and sliding doors, in a compartment to the rear of the nose landing gear. Turret contains two thermal imaging and two TV cameras, each sensor having option of narrow and wide fields of view. Turret controlled automatically, or from No. 2 tactical console.

Ultra Electronics CAMBS VI active search sonobuoy system. Acoustics system comprises antennas; receiver subsystem; acoustics processor subsystem (APSS); and acoustics recorder (AR). Five antennas dedicated to acoustics system; primary receive antenna, used to receive sonobuoy radio frequency (RF) data, and four-blade array antenna, which can also receive the sonobuoy RF data, but is primarily to collect the RF data in a suitable form to allow calculation of sonobuoy positions.

Receiver subsystem consists of the RF distribution box (RFD) and two receivers. Provides routing and switching of antenna signals to receivers; low-noise amplification, preservation of phase integrity of signals from four-blade array; and frequency translation of search and rescue (SAR) signals. Two receivers simultaneously receive the RF emissions of NATO standard sonobuoys; one performs sonobuoy positioning calculations and this will also locate a signal on one of two SAR frequencies or one SAR training frequency.

Computing Devices Canada/Ultra Electronics UYS-503/AQS-970 acoustics processor subsystem (APSS) consists of four acoustic data processors (ADPs) and one acoustics control unit (ACU), which is self-contained processor responsible for overall APSS control, human/machine interface and external interfacing. ACU contains main control processor and several external interfaces: ADP is acoustic sonobuoy processor that provides the entire APSS sonobuoy signal processing functions and also provides the functions for an embedded tactical sonobuoy simulator. Acoustic recorder for high-density digital recording of sonobuoy data.

Internal racks for normal 180 sonobuoys; maximum 360. Four Normalair-Garrett rotary launchers in rear fuselage, each holding 10 Size A buoys; two single-barrel launchers for high level (pressurised) fuselage release.

Elta EL/L-8300UK ESM provides all-round coverage, $\pm 35^\circ$ in vertical plane, with rotating antenna beneath fuselage. CAE ASQ-504(V) AIMS MAD in tailcone, transferred from Mk 2 Nimrod, although now integrated with AQS-970 processor.

Ultra Link 11 and Rockwell Collins Link 16 (JTIDS), MBDA SHF/satcom, Raytheon UHF/satcom; teletype modem.

Self-defence: Defensive aids subsystem (DASS) formulates response strategy; initiates and controls countermeasures; monitors and reports DASS activities; centralises PFM loading for all DASS equipment; provides situational awareness to aircrew; determines weapon system characteristics, advisories, system/subsystem status, and audio tones; includes automatic and operator control modes; provides selectable PFMs, response assets mode control; integrates subsystem control and information in defensive system manager; provides countermeasure response(s) to threat(s) response strategy; co-ordinates RF jamming, chaff/flare, and/or evasive manoeuvres, either individually or in unison.

DASS primary equipment comprises Lockheed Martin ALR-56M C/D-band and E- to K-band RWR; Lockheed Martin/Sanders AAR-57 missile approach warning; Lockheed Martin/Thales Vicon 78 chaff/flare dispensers (eight chaff, four flare); Lockheed Martin/Racal/Raytheon ALE-50(V) active, towed RF radar jammer. Interoperability of onboard radiators and receivers provided by modified Lockheed Martin/Lambda MX-18296/A systems manager.

ARMAMENT: Four pylons underwing, each with dedicated position for two AIM-9 Sidewinder or ASRAAM AAMs, in addition to primary weapon; plus fuselage weapon bay. Weapon

system controls carriage, release and jettison of the wing- and bomb bay-mounted stores, along with carriage, selection and release of sonobuoys. Control of weapon selection, setting and release by stores management system (SMS) and tactical command and sensor system (TCSS). Selection and release of sonobuoys is through TCSS, with SMS providing a safety interlock via the sono-inhibit/enable switch. Subsystems for stores management; carriage and release; sonobuoy release; and bomb bay door control and indication.

Typical loads could include six Harpoon or SLAM-ER ASMs (four beneath wings); 10 mines (four beneath wings); nine internal torpedoes; or five packs of three rescue containers; or five packs of three dinghies; or 12 survival containers; or single pod of 36 light series stores; each accompanied by optional underwing load of four anti-radiation missiles or AGM-65 Maverick ASMs.

DIMENSIONS, EXTERNAL:

Wing span	38.70 m (126 ft 11½ in)
Wing standard mean chord	6.10 m (20 ft 0¼ in)
Length: fuselage, incl MAD cone	38.63 m (126 ft 8¾ in)
refuelling probe to MAD cone	39.33 m (129 ft 0½ in)
overall, incl MAD static wick	40.08 m (131 ft 6 in)
Height overall	9.60 m (31 ft 6 in)
Tailplane span	14.51 m (47 ft 7¼ in)
Tailplane standard mean chord	2.74 m (9 ft 0 in)
Mainwheel track: c/l shock-absorbers	10.68 m (35 ft 0½ in)
between outer tyre rims	11.44 m (37 ft 6½ in)
Nosewheel track (tyre outer rims)	0.71 m (2 ft 4 in)
Wheelbase	14.24 m (46 ft 8½ in)

DIMENSIONS, INTERNAL:

Cabin (incl flight deck): Length	26.82 m (88 ft 0 in)
Max width	2.95 m (9 ft 8 in)
Max height	2.08 m (6 ft 10 in)
Volume	124.1 m ³ (4,384 cu ft)

AREAS:

Wings, gross	235.80 m ² (2,538.0 sq ft)
Ailerons (total)	5.63 m ² (60.60 sq ft)
Tailplane	40.41 m ² (435.00 sq ft)
Elevators, incl tabs	12.57 m ² (135.30 sq ft)

WEIGHTS AND LOADINGS:

Basic weight empty	51,150 kg (112,765 lb)
Max fuel weight	48,920 kg (107,850 lb)
Max T-O weight	106,215 kg (234,165 lb)
Max zero-fuel weight	58,285 kg (128,500 lb)
Max wing loading	450.4 kg/m ² (92.26 lb/sq ft)
Max power loading	385 kg/kN (3.78 lb/lb st)

PERFORMANCE:

Max operating Mach No. (MMO)	0.77
Service ceiling	12,800 m (42,000 ft)
Range with max internal fuel	more than 6,000 n miles (11,112 km; 6,904 miles)
Endurance, unrefuelled	more than 14 h
g limit	+3

BLA

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Aviation Group International, a privately owned company specialising in airliner maintenance and support, acquired two light aircraft programmes from FLS Aerospace, the Sprint (formerly Trago Mills/Orca SAH-1) and Optica. In 2005 was planning with business partner, Aerostar of Romania, to build both in kit form, with intended new names, Redwing and Dragonfly, respectively.



FLS Sprint (formerly Trago Mills SAH-1) which is proposed for re-launch by BLA as the Redwing (Paul Jackson) 1047832

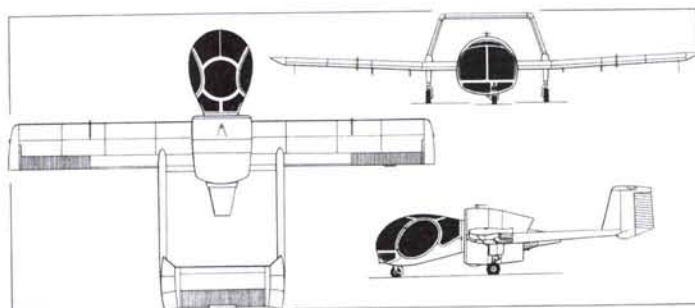
BLA DRAGONFLY (OPTICA)

TYPE: Multisensor surveillance lightplane.

PROGRAMME: Edgley OA7 Optica prototype (G-BGMW), designed by John Edgley, first flew 14 December 1979; initial production aircraft flew 4 August 1984; certified by UK CAA 12 February 1985; deliveries began to Air Foyle (two on order) 14 May 1985 and leased-out to Hampshire Constabulary same day (G-KATY); lost in flying accident 15 May, Edgley Aircraft into receivership October 1985, having built two prototypes (001 and 003) and two production aircraft (004 and 005). Currently exists as Edgley Aeronautics, producer of EA9 Optimist single-seat sailplane and EA10 two-seater.

Optica Industries formed December 1985 and took over Optica plant at Old Sarum; built 10 (c/ns 006 to 015), last of which had not flown when factory destroyed by arson on 16 January 1987, resulting in loss of nine complete aircraft. Company dissolved.

Brooklands Aircraft formed February 1987 to market EA7 under name of Optica Scout; company name changed to Brooklands Aerospace in April 1987. Specific surveillance version designated Scoutmaster, which was joint venture with ASTA of Australia. Brooklands built five Opticas (c/ns 016 to 020), last being initial Mk 301 (Series 300) version with 46 design changes, including IFR avionics, wing fences and upturned wingtips. Manufacture ended 23 March 1990 when Brooklands entered receivership.



BLA Dragonfly (Optica) observation platform (Dennis Punnett) 1047804

Programme acquired by FLS Aerospace (Lovaux Ltd) on 27 July 1990 and transferred to Hurn/Bournemouth Airport. Completed certification of Srs 300 in December 1991; assembled three inherited airframes (c/n 021 to 023); began new manufacture, but first two aircraft not completed (c/n 024 and 025). Programme offered for sale in May 1994, although Optica Srs 300 was certified by US FAA on 14 February 1995. Earlier versions retrospectively assigned Srs 100 and 200 by UK CAA.

Type Certificate acquired by Aviation Group International on behalf of subsidiary, British Light Aircraft. Agreement with Aerostar of Romania in April 2004 as risk-sharing partner for subassembly kits under provisional name of Dragonfly. Thrush Aircraft of Albany, Georgia, USA, considering becoming North American assembly centre. Relaunched version will have redesigned instrument panel and dual-bus electrical system with separate alternators.

CUSTOMERS: At least aircraft eight extant from earlier production, comprising four stored in UK (G-BPMF, G-BMPL, G-BOPO and G-BOPR); two owned by Martin Waterhouse of Narrabeen, NSW, Australia (VH-BMC and VH-OP1); and two in USA (N130DP William Bruggeman, North Oaks, Minnesota; N198DP Darrell Wallace, Hoodsville, Florida).

DESIGN FEATURES: Three-seat observation aircraft, suited particularly for pipeline and powerline inspection, photography, crime prevention and pursuit, fire patrol, game spotting. Customs and Excise duties, pollution control reconnaissance, narcotics control, disaster monitoring, survey, leisure and sightseeing, security escort, coastguard, search, accident control, police duties, film/TV and press reporting. 'Insect eye' cabin with outward view approximately 270° in vertical plane and 340° in horizontal plane, combining all-round field of view of a helicopter with lower operating costs of fixed-wing aircraft; ducted propulsor power plant unit, offering very low vibration levels and exceptional quietness, both within cabin and from ground; claimed fuel consumption 16-24 per cent of comparable light turbine helicopter, and 31 per cent of operating costs (fixed and direct for 500 hours per year); low wing loading, preset inboard flaps and low stalling speed facilitate continuous low speed flight; generous flap area provides good field performance; stressed to BCAR Section K (non-aerobatic category) and FAR Pt 23 (Normal category).

Wing section NASA GA(W)-1; thickness/chord ratio of 17 per cent; dihedral 3° on outer panels; incidence 0°.

FLYING CONTROLS: Conventional and manual. Bottom hinged, mass balanced slotted ailerons outboard of outer flaps, operated by pushrods; balanced rudders; elevators with inset trailing-edge trim tab. Fowler trailing-edge flaps (29 per cent of total wing chord) inboard and outboard of tailbooms; electrically actuated outboard flaps can be set at angles up to 50° for landing; inboard flaps set permanently at 10°, giving effect of slotted wing, for continuous low speed flying; no spoilers or airbrakes; twin inward canted fins; fixed incidence tailplane. Control surface movements: ailerons +22°/-12°; rudder ±25°; elevator +26°/30°/-19°.

STRUCTURE: Constant chord single-spar wings of 1.72 duralumin stressed skin construction; GFRP wingtips; aluminium alloy cabin with ICI Perspex windows (optionally tinted), attached to fan shroud and rest of airframe by six slators of steel tube and aluminium alloy shear web construction; steel tube and aluminium alloy nose beam supports cabin floor; horizontal window frame member just above floor level, together with nosewheel box, designed to withstand 9g impact; two movable 7.5 kg (16.5 lb) ballast weights may be positioned on nose beam; landing lamp and taxi/standby landing lamp mounted in nose beam; aluminium alloy stressed skin tubular twin tailbooms; limited GFRP in non-load-bearing areas of tail unit, including fin/tailplane fillets; two movable 9 kg (20 lb) ballast weights may be positioned in fins. Propulsor pod attached to fan shroud with four Lord rubber mountings, and supported by four stators of steel channel and aluminium alloy shear web construction, with steel tube engine bearers. Some fairings of GFRP.

LANDING GEAR: Tricycle type; fixed. Wing-mounted cantilever main legs with compressed rubber shock absorbers. Steerable nosewheel offset to port; shock absorption by bungee rubber. Tyre sizes 6.00-6 (main) and 5.00-5 (nose). Pressures 2.90 bar (42 lb/sq in) main; 3.72 bar (54 lb/sq in) nose. Hydraulic disc brakes on mainwheels. Parking brake. Nosewheel mudguard of GFRP.

POWER PLANT: Ducted propulsor unit, with engine and fan forming a power pod separate from the main shroud. Five-blade Hoffmann HO-E315/122EZ fixed-pitch fan, driven clockwise (viewed from rear) by a 194 kW (260 hp) Textron Lycoming IO-540-4A5D flat-six engine, mounted in a duct downstream of the fan. Fuel tank of 128 litres (33.8 US gallons; 28.0 Imp gallons) capacity in each wing leading-edge, immediately outboard of tailbooms and forward of wing spar. Tanks are of full wing section, but are designed not to be stressed by wing bending and torsion. Total usable fuel capacity 250 litres (66.0 US gallons; 55.0 Imp gallons); 6 litres (1.6 US gallons; 1.3 Imp gallons) unusable. Refuelling point in upper surface of each wing. Oil capacity 7.6 litres (2.0 US gallons; 1.7 Imp gallons).

ACCOMMODATION: Cabin designed to accommodate up to three persons side by side on fore and aft adjustable seats with either single- or two-pilot operation (left hand and centre seats). Dual controls standard. Baggage space aft of seats. Single elliptical door on each side, hinged at front and opening forward. Can be flown with doors removed. Cabin heated, by hot air from engine, and ventilated. Janitrol combustion heater optional.

SYSTEMS: Hydraulics for mainwheel brakes only. Electrical system (24V) includes engine driven alternator and storage battery for engine starting and actuation of flaps.



FLS Optica Scoutmaster from original production (Paul Jackson)

1047831

AVIONICS: Standard nav/com avionics by Bendix/King (Silver Crown). Alternative avionics optional.

EQUIPMENT: Special equipment tested successfully includes FLIR, Barr & Stroud thermal imager and an air-to-ground video relay. Other equipment such as BAE Systems TICM II, searchlights and loudspeakers, were assessed.

DIMENSIONS, EXTERNAL:

Wing span	12.00 m (39 ft 4 in)
Wing chord: basic, constant	1.32 m (4 ft 4 in)
over 10° fixed flaps	1.45 m (4 ft 9 in)
Wing aspect ratio	9.09
Length overall	8.15 m (26 ft 9 in)
Height over fan shroud (excl aerial)	1.98 m (6 ft 6 in)
Diameter of fan shroud	1.68 m (5 ft 6 in)
Diameter of fan	1.21 m (3 ft 11 3/4 in)
Shroud ground clearance	0.25 m (10 in)
Height over tailplane	2.31 m (7 ft 7 in)
Tail unit span:	
c/l of tailbooms	3.40 m (11 ft 2 in)
intersection fin chord	2.60 m (8 ft 6 1/2 in)
Wheel track	3.40 m (11 ft 2 in)
Wheelbase	2.73 m (9 ft 0 in)
Doors (each): Long axis	1.35 m (4 ft 5 in)
Short axis	1.96 m (3 ft 1 3/4 in)
Height to sill	0.51 m (1 ft 8 in)

DIMENSIONS, INTERNAL:

Cabin: Length	2.44 m (8 ft 0 in)
Max width (to door Perspex)	1.68 m (5 ft 6 in)
Max height	1.35 m (4 ft 5 in)
Floor area	0.72 m² (7.75 sq ft)

AREAS:

Wings, gross	15.84 m² (170.5 sq ft)
Ailerons (total)	1.55 m² (16.68 sq ft)
Trailing-edge flaps:	
inboard (total)	0.61 m² (6.57 sq ft)
outboard (total)	1.59 m² (17.12 sq ft)

Fins (total)	1.98 m² (21.31 sq ft)
Rudders (total)	1.10 m² (11.84 sq ft)
Tailplane	1.62 m² (17.44 sq ft)
Elevator, incl tab	1.26 m² (13.56 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped	948 kg (2,090 lb)
Max baggage weight	30 kg (66 lb)
Max passenger weight	227 kg (500 lb)
Max combined cabin load	231 kg (510 lb)
Max T-O and landing weight	1,315 kg (2,900 lb)
Max zero-fuel weight	1,240 kg (2,734 lb)
Max wing loading	83.0 kg/m² (17.0 lb/sq ft)
Max power loading	6.78 kg/kW (11.2 lb/hp)

PERFORMANCE (at max T-O weight, forward limit CG):

Never-exceed speed (VNE)	140 kt (259 km/h; 161 mph)
Max level speed	115 kt (213 km/h; 132 mph)
Cruising speed:	
50% power	86 kt (159 km/h; 99 mph)
70% power	103 kt (191 km/h; 119 mph)
Loiter speed (40% power)	70 kt (130 km/h; 81 mph)
Stalling speed, outboard flaps up	58 kt (108 km/h; 67 mph)
Max rate of climb at S/L	247 m (810 ft)/min
Service ceiling	4,275 m (14,000 ft)
Max certified altitude	3,960 m (13,000 ft)
T-O run	331 m (1,084 ft)
T-O to 15 m (50 ft)	472 m (1,548 ft)
Landing from 15 m (50 ft)	555 m (1,820 ft)
Landing run	278 m (912 ft)
Range with max fuel (45 min reserves):	
at 70% power	334 n miles (619 km; 385 miles)
at 70 knots (130 km/h; 81 mph)	570 n miles (1,056 km; 656 miles)
Endurance (45 min reserves):	
at 70% power	3 h 40 min
at 70 kt (130 km/h; 81 mph)	8 h
g limits	+3.8/-1.5

BNG

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CHIEF EXECUTIVE: William Hynett

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Pilatus Aircraft Ltd of Switzerland, which acquired Britten-Norman (Bembridge) Ltd 1979, sold the company on 21 July 1998 to investment group Litchfield Continental Ltd, at which time the original name Britten-Norman Ltd was re-adopted. Company sold almost immediately to Global Spill Management (environmental protection) which reformed as Biofarm (pharmaceutical manufacturer) in Romania; Agreement to purchase Romaero, long-term maker of Islander airframes, made January 1999, but not concluded. Proposed capital injection by UAE-based HSDP, early 2000, also failed to take place.

On 3 April 2000 Britten-Norman was placed in receivership; sale announced 26 April to Alawi Zawawi of Oman, and new company formed as B-N Group Ltd (BNG). Order backlog at that time stood at nearly GBP12 million.

Since April 2000, Britten-Norman has undergone a major restructuring, including formation of two wholly-owned subsidiaries: Fly BN Ltd in 2002 and Britten-Norman Aircraft Ltd in 2004. Britten-Norman has also expanded into aerospace composites, logistics, human resources and training, and now supports a wide range of products and services in the aerospace sector. Company has been producing the BN2 series of Islander, Trislander and Defender for a period spanning five decades. Customers include short-haul regional airlines and military and government agencies; company has produced in excess of 1,250 aircraft. BN2 series currently in daily use with some 500 companies and organizations in over 120 countries.

Britten-Norman Aircraft Ltd (BNA) has wide-ranging capabilities which extend from subcontract component manufacture through to integration of sophisticated sensor suites to other third-party aeroplanes and helicopters. Company is also a defence contractor specialising in the integration, installation, test and trials of mission equipment. BNA is backed by

approvals from the UK CAA, EASA (21/145) and the UK MoD and is also accredited under AS9100.

As sole manufacturer-approved providers of Britten-Norman's world-wide customer support, Fly BN Ltd (FBN) offers maintenance support for BN2 and other aircraft types. From its UK base, FBN maintains large inventories of aircraft spares which it distributes globally through a network of strategic partners and BN Logistics. FBN is independently backed by approvals from EASA.

BN Resources Ltd completes the service by providing type-rated training for pilots, mission operators, avionics technicians and engineers.

On 28 January 2002, B-N Group signed a 15-year agreement with Bembridge Airfield Ltd under which BNG will manage and develop Bembridge Airfield, thus securing the site for the manufacture and development of the Islander and Defender range. Three Defenders supplied to UK Army Air Corps in 2004.

In August 2002, BNG signed a contract with Romaero for production of 24 Islander airframes over a two-year period, with the option for Defenders to replace some of the contracted Islanders.

BNG BN2B ISLANDER

TYPE: Light utility twin-prop transport.

PROGRAMME: Prototype (G-ATCT) first flight 13 June 1965 with two 157 kW (210 hp) Rolls-Royce Continental IO-360-B engines and 13.72 m (45 ft) span wings; subsequently re-engined with Textron Lycoming O-540s and flown 17 December 1965; wing span also increased by 1.22 m (4 ft) to initial production standard; production prototype BN2 (G-ATWU) flown 20 August 1966; domestic C of A received 10 August 1967; FAA type certificate 19 December 1967; Romanian manufacture (see Romaero entry) began 1969. In July 2002, further 24 Islanders ordered by BNG from Romaero with option to include two three-engined Trislanders. Contract included completion of three Islanders in advanced state of manufacture when former B-N company entered receivership. First of these flew 2 September 2002 and delivered to UK on 5 September as BN2B-20.

CURRENT VERSIONS: **BN2 Islander:** Initial piston-engined production model (23 delivered).

BN2A Islander: Piston version built from 1 June 1969 until 1989 (see *Jane's Aircraft Upgrades*). Deliveries totalled 890.



BNG BN2 Islander (Paul Jackson)

1159149

BN2B Islander: Standard piston-engined version since 1979; higher maximum landing weight; improved interior design; available with two engine choices and optional wingtip fuel tanks as **BN2B-26** with O-540s and **BN2B-20** with IO-540s (BN2B-27 and -21 no longer available). Features include range of passenger seats and covers, more robust door locks, improved door seals and stainless steel sills, redesigned fresh air system to improve ventilation in hot and humid climates, smaller diameter propellers to reduce cabin noise, and redesigned flight deck and instrument panel.

B-N, in conjunction with Hartzell Propeller Inc, has been testing a three-blade scimitar-shaped propeller developed as part of the NASA-sponsored AGATE/GAP programme, using a BN-2B operated by the North East Police Air Support Unit. The aim of the test programme is to minimise the aircraft's noise footprint through enhanced propeller aerofoil efficiency and reduced tip speeds.

In early 2003 BNG was evaluating aero diesel engines, including the 261 kW (350 hp) SMA, for possible installation on future production Islanders, and for retrofit to existing Islanders and Trislanders.

Detailed description applies to BN2B version.

Series of modification kits available as standard or option for new production aircraft and can be fitted retrospectively to existing aircraft.

BN2B Defender: Military version. Design features as detailed under Turbine Islander and Defender entry. Customers include Indian Navy (six recently converted to turbine power), Belgian Army, Botswana Defence Forces and Jamaican Defence Force.

BN2C Islander: Proposed upgrade with 224 kW 300 hp piston engines; Hartzell scimitar-blade propellers; fuel tanks in wingtips; all-glass cockpit; window for third seating row; and enlarged cargo door. Under study in early 2004.

BN2T Turbine Islander: Described separately.

BN2T-4R Defender: Described in 1997-98 and earlier editions.

BN2T-4S Defender 4000: Described separately.

BN2A Mk III Trislander: Described separately.

CUSTOMERS: Total of 1,161 twin-engined Islanders and Turbine Islanders built by early 2006, including three (but not fourth, unflown) BN2T-4R MSSA. These assembled in UK (416 including two at Eastleigh), Belgium (179), Philippines (44) and Romania (522). At least 166 of these are current BN2B version. First to fly post-April 2000 purchase of company was G-BWNG exhibited at Farnborough Air Show, July 2000 having flown on 10 July 2000 and arrived at Bembridge on 19 July. First delivery under new ownership was a BN2B-26 delivered on 10 November 2000 to Aer Arann of Galway, Ireland, followed by another Islander delivered to Ryuku Air Commuter of Japan on 12 November 2000. One delivered in 2004 to FLN of Germany and others to Pakistan and private owners. BNG has also refurbished second-hand aircraft for new owners.

COSTS: Direct operating cost (2004): BN2B-26 USD241.85 per hour (900-1,000 hours annual utilisation; 0.90 mmh/fh).

DESIGN FEATURES: Robust STOL light transport, suitable for operation from semi-prepared airstrips. High, unswept, constant-chord wings and tailplane; sweptback fin with small fillet; upswept rear fuselage. Three-blade propellers available on BN2B-20 and BN2B-26 giving quieter noise signature.

NACA 23012 wing section; no dihedral; incidence 2°; no sweepback.

FLYING CONTROLS: Conventional and manual. Actuation by pushrods and cables. Slotted ailerons, with starboard ground-adjustable tab; mass-balanced elevator; trim tabs in rudder and elevator; single-slotted flaps operated electrically; fixed incidence tailplane. Dual controls standard.

STRUCTURE: L72 aluminium-clad aluminium alloys; two-spar wing torsion box in one piece; flared-up wingtips; integral fuel tanks in wingtips optional; four-longeron fuselage of pressed frames and stringers; two-spar tail unit with pressed ribs.

LANDING GEAR: Non-retractable tricycle type, with twin wheels on each main unit and single steerable nosewheel. Cantilever main legs mounted aft of rear spar. All three legs fitted with oleo-pneumatic shock-absorbers. All five wheels and tyres size 16x7-7, supplied by Goodyear. Tyre pressure: main 2.41 bar (35 lb/sq in); nose 2.00 bar (29 lb/sq in). Foot-operated air-cooled Cleveland hydraulic brakes on main units. Parking brake. Wheel/ski gear available optionally. Minimum ground turning radius 9.45 m (31 ft 0 in).

POWER PLANT: Two Textron Lycoming flat-six engines, each driving a Hartzell HC-C2YK-2B or -2C two-blade constant-speed feathering metal propeller; optional three-blade Hartzell HC-C3YR-2UF/FC8468-8R. Propeller synchronisers optional. Standard power plant (BN2B-26) 194 kW (260 hp) O-540-E4C5, but 224 kW (300 hp) IO-540-K1B5 fitted at customer's option (BN2B-20).

Integral fuel tank between spars in each wing, outboard of engine. Total fuel capacity (standard) 518 litres (137 US gallons; 114 Imp gallons). Usable fuel 492 litres (130 US gallons; 108 Imp gallons). With optional fuel tanks in wingtips, total capacity is increased to 814 litres (215 US gallons; 179 Imp gallons). Additional pylon-mounted underwing auxiliary tanks, each of 227 litres (60.0 US gallons; 50.0 Imp gallons) capacity, available optionally. Refuelling point in upper surface of wing above each internal tank. Total oil capacity 22.75 litres (6.0 US gallons; 5.0 Imp gallons).

ACCOMMODATION: Up to 10 persons, including pilot, on side-by-side front seats and four bench seats. No aisle. Seat backs fold forward. Access to all seats via three forward-opening doors, forward of wing and at rear of cabin on port side and forward of wing on starboard side. Baggage compartment at rear of cabin, with port-side loading door in standard versions. Exit in emergency by removing door windows. Special executive layouts available.

Can be operated as freighter, carrying more than a ton of cargo; in this configuration passenger seats can be stored in rear baggage bay. In ambulance role, up to three stretchers and two attendants can be accommodated. Other layouts possible, including photographic and geophysical survey, parachutist transport or trainer (with accommodation for up to eight parachutists and dispatcher), firefighting, environmental protection and crop-spraying.

SYSTEMS: Janaero cabin heater standard. 45,000 BTU Janitrol combustion unit, with circulating fan, provides hot air for distribution at floor level outlets and at windscreen demisting slots. Fresh air, boosted by propeller slipstream, is ducted to each seating position

for on-ground ventilation. Electrical DC power, for instruments, lighting and radio, from two engine-driven 24 V 70 A self-rectifying alternators and a controller to main busbar and circuit breaker assembly. Emergency busbar is supplied by a 24 V 25 Ah heavy-duty lead-acid battery in the event of a twin alternator failure. Ground power receptacle provided. Optional electric de-icing of propellers and windscreen, and pneumatic de-icing of wing and tail unit leading-edges. Oxygen system available optionally for all versions.

AVIONICS: *Comms:* Dual VHF nav/com with ILS; transponder; intercom, including second headset, and passenger address system, all standard. Optional ELT, HF/MF radios.

Radar: Optional weather radar in nose.

Flight: ADF, MKR, VOR, DME standard. Optional autopilot, EGPWS, TCAS and B-RNAV.

Instrumentation: IFR standard.

DIMENSIONS, EXTERNAL:

Wing span	14.94 m (49 ft 0 in)
Wing chord, constant	2.03 m (6 ft 8 in)
Wing aspect ratio	7.4
Length overall	10.86 m (35 ft 7 3/4 in)
Fuselage: Max width	1.21 m (3 ft 11 1/2 in)
Max depth	1.46 m (4 ft 9 3/4 in)
Height overall	4.18 m (13 ft 8 3/4 in)
Tailplane span	4.67 m (15 ft 4 in)
Wheel track (c/l of shock-absorbers)	3.61 m (11 ft 10 in)
Wheelbase	3.99 m (13 ft 1 1/4 in)
Propeller diameter	1.98 m (6 ft 6 in)
Cabin door (front, port): Height	1.10 m (3 ft 7 1/2 in)
Width: top	0.64 m (2 ft 1 1/4 in)
Height to sill	0.59 m (1 ft 11 1/4 in)
Cabin door (front, starboard): Height	1.10 m (3 ft 7 1/2 in)
Max width	0.86 m (2 ft 10 in)
Height to sill	0.57 m (1 ft 10 1/2 in)
Cabin door (rear, port): Height	1.09 m (3 ft 7 in)
Width: top	0.635 m (2 ft 1 in)
bottom	1.19 m (3 ft 11 in)
Height to sill	0.52 m (1 ft 8 1/2 in)
Baggage door (rear, port): Height	0.69 m (2 ft 3 in)

DIMENSIONS, INTERNAL:

Passenger cabin, aft of pilot's seat: Length	3.05 m (10 ft 0 in)
Max width	1.09 m (3 ft 7 in)
Max height	1.27 m (4 ft 2 in)
Floor area	2.97 m ² (32.0 sq ft)
Volume	3.7 m ³ (130 cu ft)
Baggage space aft of passenger cabin	1.4 m ³ (49 cu ft)
Freight capacity:	
aft of pilot's seat, incl rear cabin baggage space	4.7 m ³ (166 cu ft)
with four bench seats folded into rear cabin baggage space	3.7 m ³ (130 cu ft)

AREAS:

Wings, gross	30.19 m ² (325.0 sq ft)
Ailerons (total)	2.38 m ² (25.66 sq ft)
Flaps (total)	3.62 m ² (39.00 sq ft)
Fin	3.41 m ² (36.64 sq ft)
Rudder, incl tab	1.60 m ² (17.20 sq ft)
Tailplane	6.78 m ² (73.00 sq ft)
Elevator, incl tabs	3.08 m ² (33.16 sq ft)

WEIGHTS AND LOADINGS (A: 194 kW; 260 hp engines, B: 224 kW; 300 hp engines):

Weight empty, equipped (without avionics): A	1,866 kg (4,114 lb)
B	1,925 kg (4,244 lb)
Max disposable load: A	1,128 kg (2,486 lb)
B	1,068 kg (2,356 lb)
Payload: with max standard fuel: A	774 kg (1,706 lb)
B	715 kg (1,576 lb)
with max optional fuel: A	497 kg (1,096 lb)
B	484 kg (1,066 lb)
Max fuel weight: standard: A, B	354 kg (780 lb)
with optional tanks in wingtips: A, B	585 kg (1,290 lb)
Max T-O and landing weight: A, B	2,993 kg (6,600 lb)
Max zero-fuel weight (BCAR): A, B	2,855 kg (6,300 lb)
Max floor loading, without cargo panels: A, B	586 kg/m ² (120 lb/sq ft)
Max wing loading: A, B	99.2 kg/m ² (20.31 lb/sq ft)
Max power loading: A	7.73 kg/kW (12.69 lb/hp)
B	6.70 kg/kW (11.00 lb/hp)

PERFORMANCE (A and B as above):

Never-exceed speed (VNE): A, B	183 kt (339 km/h; 211 mph) IAS
Max level speed at S/L: A	148 kt (274 km/h; 170 mph)
B	151 kt (280 km/h; 173 mph)
Max cruising speed at 75% power at FL70: A	139 kt (257 km/h; 160 mph)
B	142 kt (264 km/h; 164 mph)
Cruising speed at 67% power at FL90: A	134 kt (248 km/h; 154 mph)
B	137 kt (254 km/h; 158 mph)
Cruising speed at 59% power at FL120:	
A	130 kt (241 km/h; 150 mph)
B	132 kt (245 km/h; 152 mph)
Stalling speed: flaps up: A, B	50 kt (92 km/h; 57 mph) IAS
flaps down: A, B	40 kt (74 km/h; 46 mph) IAS
Max rate of climb at S/L: A	262 m (860 ft)/min
B	344 m (1,130 ft)/min
Rate of climb at S/L, OEI: A	44 m (145 ft)/min
B	60 m (198 ft)/min
Absolute ceiling: A	4,145 m (13,600 ft)
B	6,005 m (19,700 ft)
Service ceiling: A	3,445 m (11,300 ft)
B	5,240 m (17,200 ft)
Service ceiling, OEI: A	1,525 m (5,000 ft)
B	1,980 m (6,500 ft)
T-O run at S/L, zero wind, hard runway: A	278 m (915 ft)
B	215 m (705 ft)
T-O run at 1,525 m (5,000 ft): A	396 m (1,300 ft)
B	372 m (1,225 ft)
T-O to 15 m (50 ft) at S/L, zero wind, hard runway: A	371 m (1,220 ft)
B	355 m (1,165 ft)

T-O to 15 m (50 ft) at 1,525 m (5,000 ft): A	528 m (1,735 ft)
B	496 m (1,630 ft)
Landing from 15 m (50 ft) at S/L, zero wind, hard runway: A, B	299 m (980 ft)
Landing from 15 m (50 ft) at 1,525 m (5,000 ft): A, B	357 m (1,170 ft)
Landing run at 1,525 m (5,000 ft): A, B	171 m (560 ft)
Landing run at S/L, zero wind, hard runway: A, B	140 m (460 ft)
Range, block-to-block, plus 10% plus 45 min reserves:	
B, standard fuel: IFR	503 n miles (931 km; 578 miles)
VFR	639 n miles (1,183 km; 735 miles)
B, with optional tanks: IFR	896 n miles (1,659 km; 1,031 miles)
VFR	1,075 n miles (1,990 km; 1,237 miles)

BNG BN2T TURBINE ISLANDER and DEFENDER

UK Army Air Corps designation: Islander AL. Mk 1

Royal Air Force designation: Islander CC. Mk 2/2A

TYPE: Utility turboprop twin.

PROGRAMME: Turboprop Islander; first flight of prototype (G-BPBN) 2 August 1980 with two Allison (now Rolls-Royce) 250-B17Cs; British CAA certification received end of May 1981; first production aircraft delivered December 1981; FAR Pt 23 US type approval 15 July 1982; full icing clearance to FAR Pt 25 gained 23 July 1984.

CUSTOMERS: Total of some 69 produced by early 2006. Several intended BN2Ts completed as BN2Bs at Romanian factory before delivery to UK, while other BN2Bs upgraded to BN2T in UK before delivery to customers. For turbine (BN2T) version, customers include Moroccan Ministry of Fisheries, Pakistan Maritime Security Agency (three, including one in August 2004), Belgian Gendarmerie, Netherlands Police, Royal Air Force, UK Army Air Corps and Mauritius Coast Guard. EAS Aviation of Abu Dhabi received one in 2005; another under conversion in 2006.

COSTS: Direct operating cost (2003) GBP158.05 per hour (900+ hours annual utilisation; 0.90 mmh/fh).

DESIGN FEATURES: As for piston-engined version; turboprops enable use of available low-cost jet fuel; low operating noise level; available for same range of applications as Islander. Defender has four underwing hardpoints for standard NATO pylons to attach fuel tanks, weapons and other stores; number of additional airframe options, including sliding door on rear port side which can be opened in flight, are also offered. Concept of Defender is to provide a low-cost airframe which can be fitted with best available sensors to meet operational needs of customers.

Description of BN2B Islander applies also to BN2T and Defender, except as follows: POWER PLANT: Two 313 kW (420 shp) Rolls-Royce 250-B17C turboprops, flat rated at 238.5 kW (320 shp), and each driving a Hartzell three-blade constant-speed fully feathering metal propeller. Usable fuel 814 litres (215 US gallons; 179 Imp gallons). Pylon-mounted underwing tanks, each of 227 litres (60.0 US gallons; 50.0 Imp gallons) capacity, are available optionally for special purposes. Total oil capacity 5.7 litres (1.5 US gallons; 1.25 Imp gallons).

ACCOMMODATION: Generally as for BN2B. In ambulance role can accommodate, in addition to pilot, a single stretcher, one medical attendant and five seated occupants; or two stretchers, one attendant and three passengers; or three stretchers, two attendants and one passenger. Other possible layouts include executive, photographic and geophysical survey; parachutist transport or trainer (with accommodation for up to eight parachutists and a dispatcher); and pest control or other agricultural spraying. Maritime Turbine Islander/Defender versions available for fishery protection, coast guard patrol, pollution survey, search and rescue, and similar applications. In-flight sliding parachute door optional.

AVIONICS: Comms: Optional maritime band and VHF transceivers.

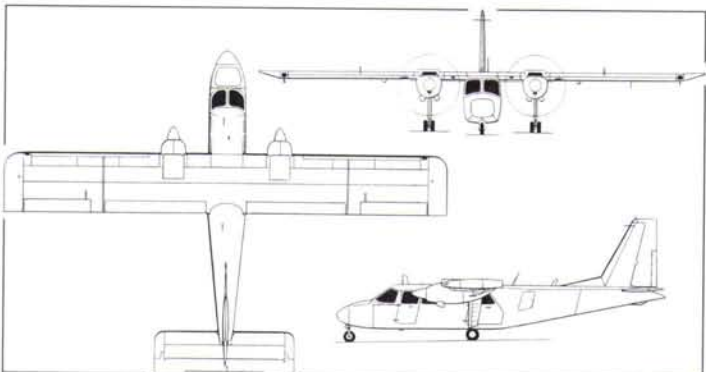
Flight: VLF/Omega nav system; radar altimeter.

Self-defence: (Military versions) Since at least 1994 Army Air Corps Islander AL. Mk 1s have had provision for AN/ALQ-144 IR jammer under fuselage. Lockheed Martin IRCM suite tested on AAC Islander in early 1998.

EQUIPMENT: According to mission, can include fixed tailboom or towed bird magnetometer, spectrometer, or electromagnetic detection/analysis equipment (geophysical survey); one or two cameras, navigation sights and appropriate avionics (photographic survey); 189 litre (50.0 US gallon; 41.5 Imp gallon) Micronair underwing spraypods complete with pump and rotary atomiser (pest control/agricultural spraying versions); dinghies, survival equipment and special crew accommodation (maritime versions). Optimal installations for British Army Islanders include photographic surveillance package of door-mounted Zeiss 610 camera, vertical Zeiss Trilens 80 mm and either F126 vertical, RMK vertical or two KS-153 vertical cameras; Vinten F143 panoramic is also available.

DIMENSIONS, EXTERNAL: As for BN2B, except:

Length overall: standard nose	10.86 m (35 ft 7¾ in)
weather radar nose	11.07 m (36 ft 3¾ in)
Propeller diameter	2.03 m (6 ft 8 in)



BNG BN2T Turbine Islander (Dennis Punnett)

0507236

WEIGHTS AND LOADINGS:

Weight empty, equipped	1,832 kg (4,040 lb)
Payload with max fuel	689 kg (1,520 lb)
Max T-O weight	3,175 kg (7,000 lb)
Max landing weight	3,084 kg (6,800 lb)
Max zero-fuel weight	2,994 kg (6,600 lb)
Max wing loading	105.2 kg/m² (21.54 lb/sq ft)
Max power loading	5.33 kg/kW (8.75 lb/shp)

PERFORMANCE (standard Turbine Islander/Defender):

Max cruising speed: at FL100	170 kt (315 km/h; 196 mph)
at S/L	154 kt (285 km/h; 177 mph)
Cruising speed at 72% power: at FL100	150 kt (278 km/h; 173 mph)
at FL50	143 kt (265 km/h; 165 mph)
Stalling speed, power off: flaps up	52 kt (97 km/h; 60 mph) IAS
flaps down	45 kt (84 km/h; 52 mph) IAS
Max rate of climb at S/L	320 m (1,050 ft)/min
Rate of climb at S/L, OEI	66 m (215 ft)/min
Service ceiling	7,620 m (25,000 ft)
Absolute ceiling, OEI	over 3,050 m (10,000 ft)
T-O run	255 m (840 ft)
T-O to 15 m (50 ft)	381 m (1,250 ft)
Landing from 15 m (50 ft)	339 m (1,110 ft)
Landing run	228 m (750 ft)
Range (IFR) with max fuel, reserves for 45 min hold plus 10%	590 n miles (1,093 km; 679 miles)
Range (VFR) with max fuel, no reserves	728 n miles (1,348 km; 838 miles)

BNG BN2T-4S DEFENDER 4000

UK Army Air Corps designation: Defender AL. Mk 1

TYPE: Multisensor surveillance twin-turboprop.

PROGRAMME: Marketing experience with BN2T Defenders revealed that many military and government agencies expressed need for greater payload; announced 1994; prototype (G-SURV) made first flight 17 August 1994; public launch at Farnborough Air Show September 1994; CAA certification achieved 13 November 1995; CAA transport (passenger) certification 4 April 1996.

Britten-Norman and Orenda Recip Inc of Canada announced in September 1999 joint study to re-engine Defender with Orenda OE600 V-8 piston engines, resulting in improved performance and efficiency. Projected specification includes maximum T-O weight 4,241 kg (9,350 lb), maximum cruising speed 176 kt (326 km/h 202 mph) and maximum rate of climb 366 m (1,200 ft)/min. However, engine programme was abandoned.

CURRENT VERSIONS: BN2T-4S Defender 4000: Standard version, as described.

National Defender: Derivative version of Defender 4000 optimised for homeland defence role; features include increased sensor payload of 1,587 kg (3,499 lb).

CUSTOMERS: Seven aircraft registered to manufacturer in April 1996. Irish Ministry of Justice took delivery of one on 14 August 1997; aircraft is operated by the Irish Air Corps at Baldonnel, Dublin, on behalf of the Garda Síochána (National Police), and is equipped with a comprehensive suite of law enforcement communications equipment, thermal imager and observers' removable consoles. Sabah Air of Malaysia took delivery of one in November 1997; primarily equipped for aerial photographic work, with quick-change facility to 12-passenger transport. Police Aviation Services UK took delivery of a single (ex-



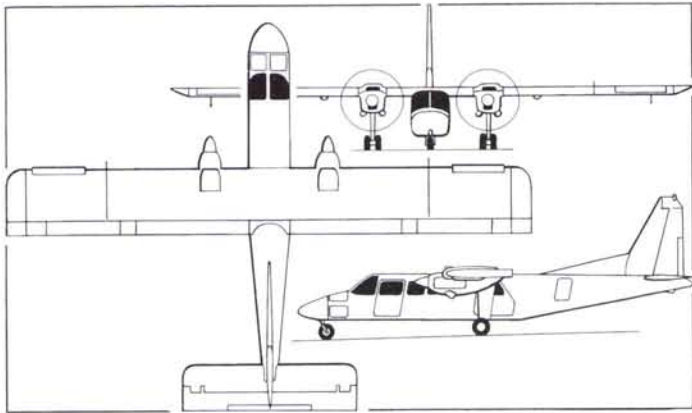
BN2T Islander equipped as demonstrator for Selex ATOS airborne tactical and observation system which is being promoted for installation in Defender 4000 (Paul Jackson)

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BNG Defender AL Mk 1 of Army Air Corps

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BNG BN2T-4S Defender 4000 (James Goulding)

1158783

demonstrator) example in November 1998, this later (2002) passed to Atlantic Air Transport, Coventry, for operation on behalf of the National Environmental Research council, Hampshire Police Authority took delivery of one (G-SJCH, named *Sir John Charles Hoddinott*) on 26 February 2001 for service with its Lee-on-Solent-based Air Support Unit, replacing a BN2B Islander. Greater Manchester Police ordered one (G-GMPB) on 15 January 2002, delivery of which was achieved on 2 July 2002. In March 2004, Army Air Corps purchased three (including prototype) for surveillance operations, first being delivered on 5 October 2004 and last on 29 April 2005; aircraft equip 651 Squadron, formed at RAF Odiham in April 2006, and operate regularly overseas, including Iraq. In mid-2006, two were at Basrah, Iraq, and one at Odiham.

COSTS: GBP2.5 million (2002). Direct operating cost USD220.90 per hour in 'surveillance' role (900-1,000 hours per year utilisation and 0.90 mmh/th).

DESIGN FEATURES: As for Islander, but with enlarged wing, based on that of Trislander, although retaining original control surfaces; compared with BN2T, has tailplane and elevator of increased span; modified fin with larger fillet; fuselage stretched by means of 0.76 m (2 ft 6 in) plug forward of wing to seat up to 16; more powerful engines for greater sortie time and payload capacity; fuselage and landing gear strengthened; flight deck windows deepened for enhanced field of view; redesigned nose and tail unit; rear-sliding door with blister window.

POWER PLANT: Two Rolls-Royce 250-B17F turboprops, each flat rated at 298 kW (400 shp) and driving a three-blade propeller. Internal fuel capacity 1,131 litres (299 US gallons; 249 imp gallons).

ACCOMMODATION: Flight crew of two on airline-type seats; sliding seat rails permit seat and equipment positioning anywhere within fuselage. Space for two or more consoles and operators in tandem along one side of cabin. Up to 16 troops/passengers in tactical transport role. Certified to carry pilot and 11 passengers, subject to local airworthiness requirements.

SYSTEMS: Electrical system includes two 200 A engine-driven generators. Full de-icing.

AVIONICS: *Comms:* Full range of open or secure voice com radios from UHF, VHF, HF and VHF-FM.

Radar: Modified nose can accommodate 68.5 cm (27 in), 360° rotating antenna for maritime, simple search or weather radar (BAE Systems Seaspray 2000 in prototype Defender 4000).

Flight: Fully integrated autopilot, GPS nav system, integrated with Omega or INS.

Mission: Sensors can include thermal imagers and/or hand-held or podded video or film cameras. Prototype on debut fitted with Agema FLIR under fuselage on starboard side; alternatives could include BAE Systems Titan, L-3 Wescam MX, LEO or FSI Ultraforce. Appropriate radars could include BAE Systems Seaspray, Telephonics RDR 1500RDR1400C or Bendix/King ART2000/2100. Other equipment could include banner/target-towing provisions, and public address systems.

Selex Sensors and Airborne Systems integrated mission sensor suite (IMSS) available from early 2006.

ARMAMENT: Two hardpoints under each wing, inboard pair stressed for loads of up to 340 kg (750 lb) and outboard pair for up to 159 kg (350 lb) each. Typical weapons include: inboard stations: reconnaissance pods, reconnaissance flares, CS gas canisters, light series canisters, gun pods, rockets, torpedoes, Sea Skua missiles, fuel tanks or flare/chaff dispensers; outboard stations: reconnaissance pods, land/sea rescue packs, marker/smoke bombs, light series canisters, gun pods or rockets.

DIMENSIONS, EXTERNAL: As for BN2B, except:

Wing span 16.15 m (53 ft 0 in)
Wing aspect ratio 8.0
Length overall 12.20 m (40 ft 0½ in)
Height overall 4.36 m (14 ft 3½ in)
Tailplane span 5.31 m (17 ft 5 in)
Wheelbase 4.76 m (15 ft 7½ in)

AREAS:

Wings, gross 32.61 m² (351.0 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped 2,223 kg (4,900 lb)
Max usable internal fuel 908 kg (2,002 lb)
Payload with max fuel 724 kg (1,598 lb)
Max T-O and landing weight 3,855 kg (8,500 lb)
Max zero-fuel weight 3,765 kg (8,300 lb)
Max wing loading 109.6 kg/m² (22.45 lb/sq ft)
Max power loading 6.46 kg/kW (10.63 lb/shp)

PERFORMANCE:

Max cruising speed: at S/L 154 kt (285 km/h; 177 mph)
at FL100 176 kt (326 km/h; 202 mph)
Transit speed from base to patrol area 160 kt (296 km/h; 184 mph)
Cruising speed at 72% power:
at FL50 149 kt (276 km/h; 171 mph)
at FL100 160 kt (296 km/h; 184 mph)
Stalling speed, power off:
flaps up 53 kt (99 km/h; 61 mph) IAS
flaps down 47 kt (87 km/h; 54 mph) IAS
Max rate of climb at S/L 381 m (1,250 ft)/min
Rate of climb at S/L, OEI 61 m (200 ft)/min
Absolute ceiling 7,620 m (25,000 ft)
Absolute ceiling, OEI 3,660 m (12,000 ft)
T-O run 356 m (1,170 ft)
T-O to 15 m (50 ft) 565 m (1,855 ft)
Landing from 15 m (50 ft) 589 m (1,935 ft)
Landing run 308 m (1,015 ft)
Max range on internal fuel:
with IFR reserves 861 n miles (1,594 km; 990 miles)
with VFR reserves 1,006 n miles (1,863 km; 1,157 miles)
Max endurance on internal fuel 8 h 30 min

BNG DEFENDER 4000 PRODUCTION

C/N	Reg/serial	Date	Operator
4005	G-SURV	17 Aug 94	(Pilatus) Britten-Norman
		19 Oct 98	Police Aviation Services
	ZG995	02	Atlantic Air Transport
		26 Mar 04	Army Air Corps assigned
		5 Oct 04	Army Air Corps delivered
4006	G-SJCH	26 Feb 01	Hampshire Police
4007	(G-BWPM)		not yet completed (reserved as BN2T-4R)
4008	255	15 Aug 97	Garda Síochána (IAC)
4009	9M-TPS	23 Nov 97	Sabah Air
4010	ZG996	26 Mar 04	Army Air Corps assigned
		23 Dec 04	Army Air Corps delivered
4011	G-GMPB	2 Jul 02	Greater Manchester Police
4012	ZG997	26 Mar 04	Army Air Corps assigned
		29 Apr 05	Army Air Corps delivered
4013	(G-BWPW)		not yet completed
4014	(G-BWPX)		not yet completed

Notes: c/n 4001-04 are BN2T-4R; two conversions and two new-build, the last-mentioned completed, but not flown. Built at Bembridge (4005 to 4010) and in Romania (4011 onwards)

CAMERON

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OPERATIONS AND PRODUCTION DIRECTORS: Lindsay Sadler

David McGibbon

PUBLIC RELATIONS: Hannah Cameron

Cameron Balloons, formed in 1970 and now part of the Cameron Holdings Group, holds CAA, FAA, French CNT, German Musterzulassungsschein, Canadian, Russian and ANO approved type certificates for its hot-air balloons. It is the world's largest manufacturer of conventional and special-shape balloons and, by early 2005, had produced 5,522 from its main factory in Bristol, of which 376 (built or on order) were special shapes. A sister company in Dexter, Michigan, USA, had produced more than 1,200 by 2002.

Details of Cameron's conventional-shape balloon range are currently available on the company website.

Cameron also designs and produces hot-air airships, being the first company to develop a craft of this type. Current production hot-air airships are predominantly the DP-80, DP-90, AS 105, the slightly more streamlined AS 105GD and the AS-120. Production of these totalled 71 by March 2006, comprising three D-38 type, 25 DP type, 10 D-50 type, 20 D-96 type and 13 AS type, in addition to six earlier DG type helium airships.

EUROPA

EUROPA AIRCRAFT 2004 LTD

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Europa Aircraft company founder Ivan Shaw previously built three Rutan canards before designing Europa for European environment, including operating from grass strips. Don Dykins, formerly British Aerospace Chief Aerodynamicist, defined aerodynamics; Barry Mellers (Chief Designer of Slingsby Aviation Ltd) made structural calculations. In October 2001, company was bought from US parent Liberty Aerospace (which see) by its management and renamed Europa Management (International). Europa was UK distributor for US-built Liberty XL-2.

Europa sales passed the 1,000 mark in late 2003, but on 6 July 2004 Europa Management was placed in receivership with debts of GBP1.3 million. It re-formed on 6 September 2004 as Europa Aircraft (2004), owned by its directors and initially concentrating on support of existing Europa fliers and constructors. By 2005, shipments had restarted of kit aircraft.

EUROPA EUROPA

TYPE: Side-by-side lightplane/motor glider kitbuilt.

PROGRAMME: Design started January 1990; prototype (G-YURO) made first flight 12 September 1992. PFA certification achieved May 1993; produced mainly in kit form under PFA auspices, but two assembled by Europa Aviation in 1994 and further three followed by 1996; first customer-built aircraft (G-OPJK) flown 14 October 1995.

Company announced sale of "1,000th" kit on 24 November 2003, but total represented orders and commitments and believed not yet achieved; in 2004, introduced new ready-to-install cockpit module, said to save at least 200 hours of build time.

CURRENT VERSIONS: **Europa Classic**: Standard aircraft; has options of several types of engine, and monowheel, tailwheel or tricycle landing gear. Superseded by XS.

Europa XS: Improved version introduced June 1997. Features include higher aspect ratio pre-moulded wings; larger ailerons; enlarged cabin providing additional legroom and seat width; Rotax 912 UL, 912 ULS or turbocharged Rotax 914 UL engine in **Turbo XS**, with new cowlings giving improved cooling, lower drag, increased propeller clearance and better field of view from cockpit; non-steerable tailwheel permitting full rudder deflection during take-off and landing; and supplementary tank holding 35 litres (9.1 US gallons; 7.6 Imp gallons) of usable fuel. Maximum take-off weight increased by 32 kg (70 lb), making it possible to fit a child's seat in the baggage area; maximum speed 174 kt (322 km/h; 200 mph); maximum range more than 869 n miles (1,609 km; 1,000 miles). Prototype (G-EUXS) first flown 21 March 1997; public debut at EAA Convention at Oshkosh July 1997. Trial installation undertaken in 1999 on G-WWWG with 89 kW (120 hp) Wilksch Airmotive WAM 120 three-cylinder Diesel.

PFA approval June 2005 for Hi-Top version, at least three of which (G-OSJN, first flight 7 March 2005; G-TOPK, 29 May 2005; and N284A, 4 June 2005) completed and flown by that time. Otherwise known as Mod 52, this allows up to 5 cm (2 in) extra headroom through incorporation of extension strip along fuselage side and increased size of engine firewall.

Europa motor glider: Alternative long-span glider wings, interchangeable in quoted 5 minutes with standard wings, and featuring trailing-edge airbrakes, maximum extension 60°, inboard of the ailerons, but no flaps; public debut, installed on demonstrator G-ODTI, at PFA International Rally at Cranfield, July 1997; first flight in this configuration on 20 November 1998; production-standard wing, which made public debut at PFA International Rally, July 2000, has winglets and extended span of 14.40 m (47 ft 3 in).

CUSTOMERS: More than 850 kits sold by mid-2006 to customers in 38 countries, of which more than 350 then flown.

COSTS: Airframe kits (XS monowheel) GBP20,795, (XS tri-gear) GBP21,295, (XS motor glider monowheel) GBP32,795, (XS motor glider tri-gear) GBP33,295; engine packages (Rotax 912 UL) GBP8,100, (Rotax 912 ULS) GBP8,940, (Rotax 914 UL) GBP13,345. Motor glider wing retrofit for XS, GBP20,000; accelerated build cockpit module GBP1,875 extra. (All prices 2006).

DESIGN FEATURES: Objectives included low-cost, economical cruise at IAS up to 120 kt (222 km/h; 138 mph) over 500 n miles (926 km; 575 miles), grass field capability, and ability to rig and de-rig quickly for storage in a trailer similar to a shorter version of glider trailer. Rig/de-rig by six pip-pins, two for tail, two for each wing. Quoted kit building time without cockpit module option is 700 hours. Designed to JAR-VLA, stressed for maximum in-flight normal *g* of 4.3; proof factor of 2.25 used in design instead of the more usual 1.5, because of extensive use of composites materials in primary structure.

Low/mid-wing layout; moderately tapered wings and tailplane; large, sweptback fin and short fuselage.

Aerofoil is laminar flow Dykins design with 12 per cent thickness/chord ratio and 2° 30' washout at tips. Modified Dykins section (15 per cent *t/c* ratio) on motor glider wings. Wing dihedral 3° (2° 30' on motor glider); no tail dihedral.

Speed Kit introduced in 1999 features outrigger mechanism and wheel fairings and flap hinge fairings for monowheel versions; and wheel, landing gear leg and flap hinge fairings for tricycle version resulting in 9 to 10 kt (17 to 18 km/h; 10 to 11 mph) speed increase for Europa XS.

FLYING CONTROLS: Manual. Conventional ailerons and rudder; all-moving tailplane for pitch control with tab geared for balance, under pilot control for trim. Ground-adjustable tabs in ailerons and rudder. Two control columns, one centrally mounted at each seat; two pairs of rudder pedals. Central console between seats has throttle, combined flap and landing gear levers. Pitch trim switch next to throttle. Slotted flaps with settings of 0° and 27°, electrically actuated on tricycle landing gear version.

STRUCTURE: General construction of GFRP.

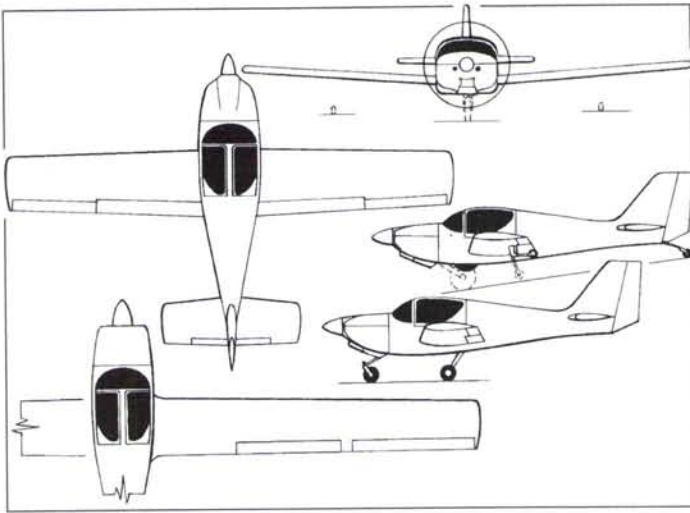
LANDING GEAR: Monowheel version has large, single, semi-retractable mainwheel, with brake, and steerable tailwheel; outriggers at about half-span mounted on nylon stalks which retract with flaps. Mainwheel uses standard 6 in hub, as in many light aircraft; and an 8.00-6 Tundra tyre. Tricycle landing gear version has fuselage-mounted, fixed, spring steel cantilever legs, castoring nosewheel, and toe brakes on port side rudder pedals; or finger brakes on central tunnel to starboard side of throttle lever. Mainwheel tyre size 5.00-5, nosewheel 4.00-5. Tailwheel landing gear kit offered by Aero Developments of Kemble, UK.

POWER PLANT: One 59.6 kW (79.9 hp) Rotax 912 UL flat-four engine, directly driving a three-blade fixed-pitch Warp Drive propeller; propeller pitch is adjustable on ground to match operating environment (fine pitch for good take-off distances and rate of climb but higher noise and lower cruising speeds; reverse for coarse pitch); alternatively, one 73.5 kW



Europa tri-gear version, built by Brian J Tarmar (Paul Jackson)

1158859



Standard (monowheel) version of Europa, with additional side elevation of tricycle option and partial plan view of Europa Motor Glider
(James Goulding)

1158769

(98.6 hp) Rotax 912 ULS or one 84.6 kW (113.4 hp) turbocharged Rotax 914 UL, driving a three-blade variable-pitch NSI or Airmaster propeller. Alternative Subaru/NSI EA81 installation in 73 kW (98 hp) and 88 kW (118 hp) form first flown (G-NDOL) 18 November 1995. MWAFA rotary (73 kW: 98 hp), BMW 1100RS (67.1 kW: 90 hp) and 89 kW (120 hp) Wilksch WAM 120 engine installations under development, the first-mentioned installed in UK prototype G-YURO and UK- and US-built tricycle gear demonstrators (G-KITS and N496TG); BMW engine began ground running trials in the third quarter of 1996. Jabiru 3300 offered from 1998.

Normal fuel capacity 68.2 litres (18.0 US gallons; 15.0 Imp gallons); optional 104.6 litres (27.6 US gallons; 23.0 Imp gallons).

ACCOMMODATION: Enclosed cabin seating two side by side under individual upward-opening canopies, hinged on centreline. Baggage compartment at rear of cabin.

SYSTEMS: Hydraulics: mainwheel brake. Electrical: 12 V 30 Ah battery; alternator fit appropriate to engine.

AVIONICS: Customer choice.

DIMENSIONS, EXTERNAL:

Wing span: XS	8.28 m (27 ft 2 in)
motor glider	14.40 m (47 ft 3 in)
Wing chord (XS): at root	1.27 m (4 ft 2 in)
at tip	1.00 m (3 ft 3½ in)



Europa monowheel G-EORJ, built by Philip George (Paul Jackson)

1158860

Wing aspect ratio: XS	7.2
motor glider	15.6
Width, wings removed	1.17 m (3 ft 10 in)
Length overall	5.84 m (19 ft 2 in)
Height overall: monowheel	1.32 m (4 ft 4 in)
tricycle	2.13 m (7 ft 0 in)
Tailplane span	2.44 m (8 ft 0 in)
Wheel track (tricycle)	1.83 m (6 ft 0 in)
Wheelbase (tricycle)	1.47 m (4 ft 9¾ in)
Propeller diameter	1.57 m (5 ft 2 in)
Propeller ground clearance: XS	0.39 m (1 ft 3½ in)

DIMENSIONS, INTERNAL:

Cabin: Length: XS	1.83 m (6 ft 0 in)
Max width	1.12 m (3 ft 8 in)
Max height	0.97 m (3 ft 2 in)
Baggage volume: XS	0.64 m³ (22.5 cu ft)

AREAS:

Wings, gross: XS	9.48 m² (102.0 sq ft)
motor glider	13.29 m² (143.0 sq ft)
Ailerons (total): XS	0.62 m² (6.650 sq ft)
Trailing-edge flaps (total)	1.37 m² (14.70 sq ft)
Fin	1.03 m² (11.10 sq ft)
Rudder	0.48 m² (5.20 sq ft)

WEIGHTS AND LOADINGS (standard aircraft unless otherwise stated):

Weight empty, equipped: XS monowheel	340 kg (750 lb)
XS tricycle	354 kg (780 lb)
motor glider	358 kg (790 lb)
Baggage capacity	36 kg (80 lb)
Max T-O and landing weight: XS and motor glider	621 kg (1,370 lb) ¹
Payload with full fuel	197 kg (435 lb)
Max wing loading: XS	65.6 kg/m² (13.43 lb/sq ft)
motor glider	46.8 kg/m² (9.58 lb/sq ft)
Max power loading:	
Rotax 912 ULS	8.46 kg/kW (13.89 lb/hp)
Rotax 914 UL	7.35 kg/kW (12.08 lb/hp)

¹ 657 kg (1,450 lb) permitted in USA only

PERFORMANCE, POWERED (XS and motor glider with Rotax 912 ULS engine, unless otherwise stated):

Max cruising speed at 75% power:

Rotax 912 ULS at FL80: monowheel	140 kt (259 km/h; 161 mph)
tricycle	135 kt (250 km/h; 155 mph)
motor glider	130 kt (241 km/h; 150 mph)
Rotax 914 UL at FL100: monowheel	174 kt (322 km/h; 200 mph)
tricycle	166 kt (307 km/h; 191 mph)
Rotax 914 UL at FL175	151 kt (280 km/h; 174 mph)
Econ cruising speed: motor glider	100 kt (185 km/h; 115 mph)
Stalling speed, power off: flaps up	50 kt (92 km/h; 57 mph)
flaps down	45 kt (83 km/h; 51 mph)
Max rate of climb at S/L: Rotax 912 ULS: XS	305 m (1,000 ft)/min
motor glider	335 m (1,100 ft)/min
Rotax 914 UL: XS and motor glider	396 m (1,300 ft)/min
T-O run: Rotax 912 ULS: XS	180 m (590 ft)
motor glider	183 m (600 ft)
Rotax 914 UL: XS and motor glider	153 m (500 ft)
Landing run: all	183 m (600 ft)
Range at econ cruising speed: standard fuel	732 n miles (1,355 km; 842 miles)
optional fuel	1,093 n miles (2,024 km; 1,257 miles)
g limits (all): design	+3.8/-1.9
ultimate: XS	+8.55/-4.27
motor glider	+10.87/-4.27

PERFORMANCE, UNPOWERED (motor glider):

Best glide ratio at 53 kt (98 km/h; 61 mph) IAS	27
Min rate of sink at 47 kt (87 km/h; 52 mph)	1.02 m (3.33 ft)/s

FACIL

FARNBOROUGH AIRCRAFT CORPORATION LTD

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CHAIRMAN AND CEO: Geoffrey Galley

TECHNICAL DIRECTOR: Afandi Darlington

COMMERCIAL DIRECTOR: Richard Blain

US OFFICE:

2711 Centerville Road, Suite 400, Wilmington, Delaware 19808-1645

Former Farnborough-Aircraft.com (FAC) applied for insolvency protection in first half of 2002; this rejected, but 51 per cent of shareholders voted on 8 July 2002 for restructuring under new company title FACIL, as above, and continuation with development of the F1 business turboprop. Reported in late 2004 that major investor Geoffrey Galley had agreed to maintain financing project, enabling completion of prototype in US, where maiden flight achieved July 2006.

Aircraft became joint programme with Gulf Aircraft Maintenance Corporation (GAMCO) in November 2005, when MoU (renewed in late 2006) signed to create Gulf Aircraft Partnership (GAP) to produce aircraft as Kestrel JP100. Description now appears under that heading in International section of *All the World's Aircraft*.

US OFFICE:

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FanWing Ltd was incorporated on 3 August 1999 to develop manned and unmanned rotary-wing aircraft of a particularly unorthodox concept. Preliminary designs for the ultralight version have received funding support from the UK government's London Development Agency. With this backing, discussions were being held in March 2006 towards finding major investment and partnership for a first manned prototype.

ITALIAN OFFICE:

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FANWING ULTRALIGHT

TYPE: Technology demonstrator.
PROGRAMME: Began with small-scale, unmanned model designed in Italy and flown September 1998; several more scale versions subsequently, gradually increasing lifting efficiency and glide ratio; these led to August 2002 development grant from UK Department of Trade and Industry for commercial surveillance UAV version which began flight testing September 2003. Winglets added November 2003 and re-flown at 17.5 kg (38.6 lb) gross weight including 8 kg (17.6 lb) of payload. Subsequent upscaling reached 21 kg (46.3 lb) gross



Artist's impression of FanWing Ultralight (Jon Linney) 1129497

with 12 kg (26.5 lb) payload by June 2004. Plans for 2006-07 included new collaboration on 200 kg (441 lb) UAV to permit heavier payloads including radar and, in a separate development, to optimise VTO capability.
Ultralight is first planned application of FanWing principle to a piloted version. Future applications foreseen include local transport, agricultural sprayer, patrol, ambulance, ground penetrating and surface surveillance, firefighting and other civil and military missions. Principle could also be applied to a medium-size passenger transport or freighter. First stages of final design process involve new simulation project at Imperial College, London. Partnership discussions in progress during early months of 2006.
DESIGN FEATURES: Conventional wing is replaced by a combination of multiblade, backward-rotating cylinders, driven by a centrally mounted engine, immediately ahead of a narrow chord wing. Fan effect of the cylinders draws in air and accelerates it over the trailing-edge, generating lift even when the aircraft is stationary.
Lifting efficiency and performance increase with size, and wind tunnel testing has indicated that a full-sized FanWing could lift up to 2 tons weight with only 74.6 kW (100 hp) of power. Rotor rpm less than 1,000, thus producing low noise. Wing said to be unable to stall; lift declines gradually with forward speed until static lift limit is reached. Narrow chord wing is affected less by turbulence than a conventional wing, enhancing gust resistance. No sharp air flow separation from wing trailing-edge at any stage of the flight envelope. Other attributes include stable low/slow flying speeds and low noise levels.
FLYING CONTROLS: Three fan sections per wing. Leading-edge flaps provide principal aerodynamic control of both lift and thrust; by increasing the blanking effect of these on one wing and reducing them on the other, aircraft will turn without yawing.
Following provisional details apply to the projected Ultralight.
POWER PLANT: Two 22.4 kW (30 hp) piston engines.
ACCOMMODATION: Pilot and one passenger.
DIMENSIONS, EXTERNAL:
Wing span 10.00 m (32 ft 9¾ in)
WEIGHTS AND LOADINGS:
Weight empty 350 kg (772 lb)
PERFORMANCE (estimated):
Max level speed 55 kt (101 km/h; 63 mph)
Min level speed 20 kt (37 km/h; 23 mph)
Ceiling 6,000 m (19,680 ft)
Endurance 10 h

LAYZELL

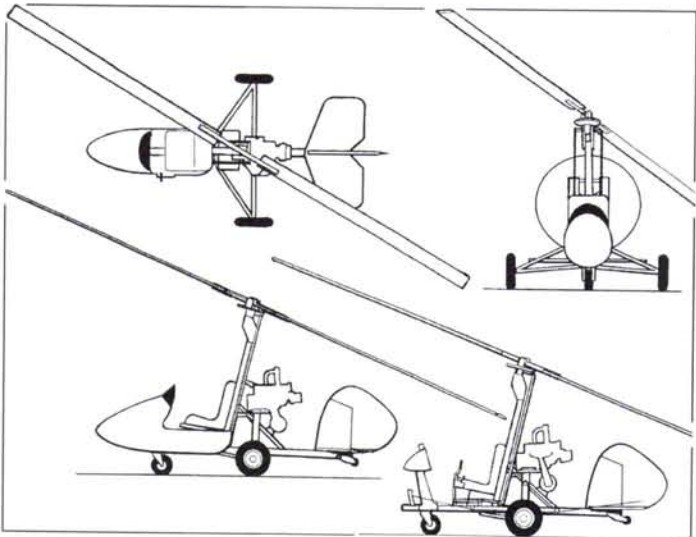
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e-mail: info@layzellgyroplanes.com
Web: www.layzellgyroplanes.com
DIRECTOR: Gary J Layzell

Mr Layzell formed his company in July 2002 to manufacture autogyro kits and accessories. The company is developing its own design of rotor blade, which will be available for fitment to other craft.

LAYZELL AV-18

TYPE: Single-seat autogyro ultralight kitbuilt.
PROGRAMME: AV-18 incrementally developed from Bensen B-8M Gyrocopter, which built under licence at Membury by Campbell Aircraft from 1960 until 1968, when rights withdrawn; Campbell then adopted version with 1,600 cc VW engine, developed privately by Peter Lovegrove, which first flew as Campbell Cricket in July 1969 and certified 14 November 1969. Following closure of original Campbell company, derivative design marketed since 1984 by Everett Engineering of Ipswich as kitbuilt Everett Gyroplane.
Having produced two further versions of Cricket for personal use, Mr Lovegrove was invited in 1996 by the Popular Flying Association to design Cricket Mk 4 as plans-built version, available from British Gyroplanes of Wallingford, incorporating Rotax engine and other improvements, fully meeting PFA safety requirements. This followed in 2000 by single Mk 5 with 'Cierva-sized' horizontal stabiliser. Mk 6 is plans-built successor to Mk 4.
Prototype AV-18, G-CBWN, built in May 2003 from Cricket Mk 6, incorporating several minor changes—again engineered by Mr Lovegrove—to facilitate mass-production of kits for home assembly. Permit to Fly granted 7 March 2005 following CAA flight testing. Partly enclosed AV-18B produced in 2006.
CURRENT VERSIONS: AV-18A: Open version; as prototype.
AV-18B: With protective nosecone.

COSTS: GBP5,800, less engine, rotors, nosecone and instruments (2006).
DESIGN FEATURES: Typical Bensen formula autogyro with two-blade Rotordyne rotor and optional pre-rotation mechanism; low-mounted horizontal stabiliser strut-braced to fin. Meets BCAR Section T standards.
FLYING CONTROLS: Manual. Horn-balanced rudder. Floor-mounted control column.
STRUCTURE: Aluminium alloy tube, plus square section keel; with composites empennage and optional nosecone.
LANDING GEAR: Tricycle type; fixed. Mainwheels mounted on horizontal tube metal Vs, each with damped arm anchored to main engine support. Steerable nosewheel. Auxiliary tailwheel.
POWER PLANT: One 48.0 kW (64.4 hp) Rotax 582 DCDI two-cylinder, liquid-cooled two-stroke driving a GSC Tech III three-blade, ground adjustable pitch wooden propeller. Air-cooled, 37.0 kW (49.6 hp) Rotax 503 option for AV-18B. Fuel tank behind and below seat, capacity 36.0 litres (9.6 US gallons; 8.0 Imp gallons).
DIMENSIONS, EXTERNAL:
Rotor diameter 6.71 m (22 ft 0 in)
Length of fuselage: AV-18A 3.20 m (10 ft 6 in)
AV-18B 3.73 m (12 ft 3 in)
Height overall 2.03 m (6 ft 8 in)
Wheel track 1.68 m (5 ft 6 in)
AREAS:
Rotor disc 35.31 m² (380.1 sq ft)
WEIGHTS AND LOADINGS:
Weight empty 141 kg (310 lb)
Max T-O weight 294 kg (650 lb)
PERFORMANCE:
Max rate of climb at S/L 198 m (650 ft)/min



Layzell AV-18B, with additional side view of AV-18A open version (Paul Jackson) 1158258



Prototype Layzell AV-18A single-seat autogyro 1180241

MEDWAY

MEDWAY MICROLIGHTS

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 DIRECTORS:

Chris Draper
 Karen Draper

After two decades of building weight-shift microlights such as Av8r, EclipseR and HybredR with its own Raven Rogallo wing, UK's oldest approved microlight manufacturer added its first three-axis aircraft in 2006.

MEDWAY SLA100 EXECUTIVE

TYPE: Side-by-side ultralight.

PROGRAMME: Prototype (G-CCJJ) registered in August 2003 and made unannounced first flight about same time. Further two development/demonstrator aircraft flown early 2006 before public unveiling at International Microlight Exhibition, Popham, Hampshire, on 29-30 April 2006.

COSTS: GBP28,995 including tax with Rotax 912 UL; GBP1,000 extra for Rotax 912 ULS (2006).

DESIGN FEATURES: High, constant-chord wing braced to lower longerons by streamlined V-struts and auxiliary struts. Sweptback fin with full-height rudder; empennage mutually braced by wires.

FLYING CONTROLS: Conventional and manual. Flaps. Actuation by cables; electrically operated pushrods for flaps. Flight-adjustable tab on port elevator.

STRUCTURE: Bolted tubular aluminium with laced Dacron covering for all surfaces, except composites forward of windscreen.

LANDING GEAR: Tricycle type; fixed. Twin Vs (forward strut streamlined; aft tubular) hinged on centreline, plus oleo-damped tubular leg attached to lower longerons, each side. Forward-canted, steerable cantilever nosewheel leg. Mainwheels 3,50-6; nosewheel 5,50-6. Hydraulic brakes. Optional mainwheel fairings.

POWER PLANT: One liquid-cooled Rotax flat-four driving a three-blade, ground adjustable pitch propeller: 59.6 kW (79.9 hp) Rotax 912 UL; or 73.5 kW (98.6 hp) Rotax 912 ULS. Fuel behind seats: capacity 100 litres (26.4 US gallons; 22.0 Imp gallons) when flown solo; 20 litres (5.3 US gallons; 4.4 Imp gallons) with two crew.

DIMENSIONS, EXTERNAL:

Wing span 9.69 m (31 ft 9½ in)
 Length overall 5.71 m (18 ft 9 in)
 Height overall 2.26 m (7 ft 5 in)

DIMENSIONS, INTERNAL:

Cabin max width 1.19 m (3 ft 10¾ in)

WEIGHTS AND LOADINGS:

Max T-O weight 450 kg (992 lb)

PERFORMANCE:

Never-exceed speed (VNE) 107 kt (200 km/h; 124 mph)
 Max level speed 82 kt (153 km/h; 95 mph)
 Cruising speed at 4,800 rpm 70 kt (129 km/h; 80 mph)
 Stalling speed, flaps down 33 kt (60 km/h; 37 mph)
 Max rate of climb at S/L 259 m (850 ft)/min



Medway SLA100 Executive at the type's public announcement, Popham, 29 April 2006 (Paul Jackson)

0581615

NEWGEN

NEWGEN ROTORCRAFT LTD

The Forge, Cattistock, Dorchester, DT2 9JD
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 Web: www.flygyro.co.uk
 DIRECTOR: Malcolm Reid
 MANAGING DIRECTOR: Martin Deady

NewGen was established in November 2001, as a private company, by Martin Deady, former Chief Mechanical Systems Engineer at Westland Helicopters. Company's function is to design, certify and produce an autogyro which it terms a continuous autorotation light aircraft—very light gyroplane: CARLA-VLG.

NEWGEN CARLA

TYPE: Two-seat autogyro.

PROGRAMME: Promotional mockup, based on fuselage of G-WOLV (a standard Ikarus C42 FB100 aeroplane supplied by UK importers Aerosport Ltd of Wolverhampton), exhibited, at London Air Show, 21 to 23 April 2006 (and subsequently returned to aeroplane configuration). By mid-2006, CARLA concept had passed technical and marketing assessment by UK Department of Trade & Industry. Development continues.

DESIGN FEATURES: Intended to fill a market niche and offer improved operating envelope when compared with teetering, two-blade autogyros; this is combined with purchase and operating costs similar to those near the upper end of volume-production motorcars. Unique rotor design to provide safe flight in a wide range of conditions, notably gusts



Prototype NewGen CARLA-VLG at its public debut in April 2006

1158274

and unexpected manoeuvres; offers unstallable flight and handling characteristics with symmetric, non-coupled control, similar to aeroplane. Jump start and vertical landing.

Four-blade rotor designed by NewGen and with NACA 8-H12 aerofoil section, mounted on rotor mast attached to otherwise conventional C42 B fuselage.

FLYING CONTROLS: Manual. Include conventional rudder and elevators.

STRUCTURE: As Ikarus C42.

LANDING GEAR: As Ikarus C42.

POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS flat-four driving a three-blade, nose-mounted propeller.
ACCOMMODATION: Two persons, side by side.
DIMENSIONS, EXTERNAL:
Rotor diameter 8.00 m (26 ft 3 in)
Fuselage: Length 7.00 m (22 ft 11½ in)
Max width 1.40 m (4 ft 7 in)

WEIGHTS AND LOADINGS:
Disposable load 250 kg (551 lb)
PERFORMANCE (estimated):
Max level speed 100 kt (185 km/h; 115 mph)
Normal cruising speed 80 kt (148 km/h; 92 mph)
Min cruising speed 18 kt (34 km/h; 21 mph)
Range 350 n miles (648 km; 402 miles)

REALITY

REALITY AIRCRAFT LTD

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MANAGING DIRECTOR: Terry Francis
MARKETING DIRECTOR: Tom Lafferty
DIRECTOR: Kate Mather

Reality previously marketed the Easy Raider, for which it has world rights, except in the USA, but is now concentrating on the new (2003) Escapade. By mid-2006, six Easy Raiders flying and further five under construction. US partner, Just Aircraft LLC, developed the Escapade for which it previously supplied components to the UK until indigenous sourcing was achieved in 2005. A related aircraft, the Just Summit, is marketed only in the USA.



Completions of Reality Easy Raiders continue, although kit manufacture has ended (Paul Jackson) 1159071

REALITY (JUST PLANE) ESCAPADE
TYPE: Side-by-side ultralight kitbuilt.
PROGRAMME: US prototype, built by Just Aircraft LLC of Caldwell, Idaho, first flew (N116JA, Rotax engine) 22 February 2003 and made its public debut at Sun 'n' Fun, Lakeland, Florida, 2 to 8 April 2003; UK prototype (G-ESCA, Jabiru engine) followed on 2 June 2003, with debut at PFA International Rally, Kemble, 11 to 13 July 2003. G-ESCA awarded UK Permit to Fly on 18 September 2003. Grand Champion lightplane at Sun 'n' Fun 2004. VLA version with 500 kg (1,102 lb) MTOW under construction in mid-2005.
CURRENT VERSIONS: **Escapade:** As described.
Highlander: Introduced 2004; 20 cm (8 in) taller, square-cornered fin; and additional 89 cm (2 ft 11 in) wing span and 1.18 m² (12.75 sq ft) area to maintain stalling speed. 'Bush plane' featuring enlarged, horn-balanced elevator, horn-balanced rudder and associated trim tab; vortex generators along full span of wing leading-edge upper surface; extended, strengthened landing gear with 8.50-6 tundra tyres and brakes; Rotax 912 ULS engine; and gull-wing, flight-openable doors. First aircraft, N8056A, built from 13th Escapade kit. Not being marketed in UK: suitable for US LSA or Experimental class. Weight empty 272 kg (600 lb); MTOW 598 kg (1,320 lb).
CUSTOMERS: By mid-2006, 11 flying and 15 more under construction in UK. Further 85 sold in US and elsewhere for total of some 110 kits (at least 14 Highlanders) delivered by early 2006.



Just Plane Highlander US Experimental/LSA version (Paul Jackson) 1159073

DIMENSIONS, EXTERNAL:	
Wing span	8.69 m (28 ft 6 in)
Width, wings folded	2.42 m (7 ft 11½ in)
Length excl propeller	5.79 m (19 ft 0 in)
Height overall: tailwheel	1.75 m (5 ft 9 in)
nosewheel	2.18 m (7 ft 2 in)
DIMENSIONS, INTERNAL:	
Cockpit max width	1.12 m (3 ft 8 in)
AREAS:	
Wings, gross	10.03 m ² (108.0 sq ft)

WEIGHTS AND LOADINGS:	
Weight empty (Rotax 912)	255 kg (562 lb)
Max T-O weight: in UK	450 kg (992 lb)
in USA	558 kg (1,232 lb)
PERFORMANCE (Rotax 912 at US MTOW):	
Normal cruising speed	80 kt (148 km/h; 92 mph)
Stalling speed, power off, flaps down	23 kt (43 km/h; 27 mph)
Max rate of climb at S/L	268 m (880 ft)/min
T-O and landing run	92 m (300 ft)
g limits	+4/-2

SKYCAT

SKYCAT GROUP

No 2 Hangar, Cardington Field, Shortstown, Bedford MK42 0TJ

Web: www.skycatgroup.com (reserved)

CEO: Egidio Di Lorenzo

TECHNICAL DIRECTOR: Roger Munk

ATG became the trading name, from June 2000, of Airship Technologies Services Ltd, which was created in February 1996 to revive the activities of the former Airship Industries company, responsible for the British-designed Skyship 500/600 series. On 26 July 2005, ATG went into administration under Part II of the Insolvency Act of 1986 to allow the company, which had received about GBP30 million in investment since 1996, time to refinance and restructure, possibly under new ownership. Purchase by a British-Italian consortium was duly announced on 1 June 2006, with ATG financially restructured under the new name SkyCat Group for a purchase price of GBP1 million plus a percentage of any profits made during the first eight years. It will be staffed by personnel from both countries: former ATG investors and management from the UK, plus aerospace management personnel (including the new CEO) from Finmeccanica and other Italian industry sources. Activity continues to be based at the former ATG facility in Cardington, UK.

Current work will continue to be directed towards new concepts in lighter-than-air design: SkyCat, a hybrid air vehicle, and StratSat, a stratospheric telecommunications platform. SkyCat has a fully amphibious design incorporating a sophisticated lifting body, ellipsoidal cross-section hull and a catamaran hover cushion landing system which equips it to land on a grass field, a swamp, sand, snow or open sea.

In March 2002, ATG had announced the first flight of its AT-10 airship, intended for advertising work, as a camera platform, and for surveillance and pilot training applications. The AT-10, SkyCat 20 and StratSat were all designed to be powered by ATG diesel engines ranging from 74.6 to 447 kW (100 to 600 hp). Of these, the 100 hp engine was ready for limited production in early 2004, the first series example completing its CAA acceptance test on 15 January. At that time the 600 hp engine had reached prototype completion and testing status. In late 2002, ATG announced receipt of a contract from Japanese engine maker IHI for a propulsion system for a low-altitude flight test airship, an initial stage in Japan's programme to develop an unmanned airship-based stratospheric telecommunications and surveillance system. This propulsion system had been delivered and tested by early 2004.

SKYCAT AT-10

TYPE: Helium non-rigid airship.

PROGRAMME: Prototype registered G-OATG in November 2001; made first flight 28 March 2002. Phase 2 flight testing completed by July 2003; C of A (Airship Special Category) awarded 4 March 2004; more than 125 hours accumulated by July 2005.

CUSTOMERS: First sale announced in May 2001, to Chinese operator for advertising and police surveillance duties in Shanghai area. This airship only partially completed by July 2005.

DESIGN FEATURES: Commercial airship with capability for advertising and camera platform use and for other applications such as pilot training. X configuration tailfins.

FLYING CONTROLS: Split-channel, optically signalled flight control system incorporating sidestick controllers, powered flight actuators and an Ada control system interface; provision for autopilot. Single ballonnet centrally located over gondola for envelope pressure control.

STRUCTURE: Envelope of laminated translucent fabric with external catenary collar system supporting gondola. Provision for internal mercury illumination system.

LANDING GEAR: Non-retractable bicycle type, coil-sprung with oleo damping; twin wheels on each unit.

POWER PLANT: Two 74.6 kW (100 hp) (59.7 kW; 80 hp maximum continuous) A-Tech 100 horizontally opposed, two-stroke, direct injection Diesel engines with vectorable-thrust ducted propellers. Supercharged induction system.

ACCOMMODATION: One or two pilot stations with sidestick controls; four or five passenger seats on multiple tracks; large flight deck and passenger cabin transparencies; large passenger door on port side. Rear of gondola contains lavatory, ballonnet air system, pneumatics, electrical services and cabin heater.

SYSTEMS: Low-pressure pneumatic system to power flight control actuators and provide low susceptibility to lightning strike and electromagnetic interference. Electrical power (28 V DC) from 6 kVA alternator.

DIMENSIONS, EXTERNAL:	
Length overall	41.40 m (135 ft 10 in)
Max diameter	10.70 m (35 ft 1¼ in)
Height overall	13.60 m (44 ft 7½ in)

DIMENSIONS, INTERNAL:	
Envelope volume	2,500 m ³ (88,290 cu ft)
Gondola: Length	4.40 m (14 ft 5¼ in)
Max width	1.52 m (4 ft 11¼ in)
Width at floor	0.83 m (2 ft 8¾ in)
Min height	1.86 m (6 ft 1¼ in)

WEIGHTS AND LOADINGS:	
Max payload	740 kg (1,631 lb)

PERFORMANCE (design):	
Max level speed	60 kt (111 km/h; 69 mph)
Cruising speed	50 kt (93 km/h; 58 mph)
Pressure ceiling	2,745 m (9,000 ft)
Max range at 30 kt (56 km/h; 35 mph)	1,020 n miles (1,889 km; 1,173 miles)
Endurance at 30 kt (56 km/h; 35 mph)	34 h

SKYCAT SKYCAT

TYPE: Hybrid non-rigid air vehicle.

PROGRAMME: Launched 29 June 2000, with three versions announced; name derived from 'sky catamaran'; numerals in designations indicate payload capacity in tonnes. Preceded by SkyKitten I, a 12.2 m (40 ft) long proof-of-concept prototype; first flight (retrospectively allocated, but did not carry, UK 'B Conditions' registration G-86-01 which eventually applied instead to one-tenth scale StratSat prototype) 28 June 2000; more than 30 short flights, from land and water, by early 2001; bow thruster added. SkyKitten II (13.5 m; 44.3 ft long, envelope volume 145 m³; 5,120 cu ft) is one-seventh scale representation of SkyCat 20; 3.0 kW (4 hp) engines (being test-run in early 2004); retractable hover skirts (to be fitted after first flight); envelope shape identical to SkyCat 20. Shown statically at Paris, June 2001, registered G-86-02.

CURRENT VERSIONS: **SkyCat 20:** Initial operational version. Manufacture under way by mid-2000; not completed by July 2005. Maiden flight now reportedly targeted for late 2008.

SkyCat 220: Second, and larger, operational version (originally 200). Work started on payload module. Industrial partner IAR Brasov (which see under Romania) was due to begin deliveries of major subassemblies in 2001, but these not known to have taken place.

SkyCat 1000: Largest in current range. Subject in 2001 of US Army study contract to assess ultra-heavy-lift potential; completed study delivered to US Army in 2002.

CUSTOMERS: First SkyCat 20 ordered by World SkyCat Ltd of Wytham Abbey, Oxford, UK (tel: +44 1865 72 50 15).



Prototype AT-10 four/five-passenger airship

0589387

SLINGSBY

SLINGSBY AVIATION LIMITED

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 e-mail: sales@slingsby.co.uk
 Web: www.slingsby.co.uk
 CHIEF DESIGNER: David Goddard
 SALES DIRECTOR: Steven Boyd

Formerly a subsidiary of ML Holdings, Slingsby was sold to Cobham plc in 1997 and is a component of Chelton Group within that holding. Company specialises in application of

composites materials: was previously manufacturer of sailplanes but then concentrated on development and low-rate production of T67 Firefly series of aerobatic training aircraft, for which new orders received in 2001-02 and delivered by February 2003. Slingsby Aviation has site area of 12,220 m² (131,535 sq ft) and workforce of about 130; also has own airfield with 750 m (2,460 ft) reinforced grass runway.

Other activities include design and manufacture of air cushion vehicles and design, development and manufacture of high-performance composites structures for marine and aerospace industries. Supplier to Lockheed Martin of C-130J cockpit interior trim panels in sculptured composites. Other production includes emergency detainment door systems, fast-jet helmets, airframe aerostructures and propeller spinners for Bombardier Dash 8 Q400.

Work for UK MoD includes technical support for RAF Air Cadet gliders and Firefly aircraft.

WARRIOR

WARRIOR (AERO-MARINE) LTD

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 Fax: (+44 1722) 42 18 61
 e-mail: jlabouchere@centaureaplane.com
 Web: www.centaureaplane.com
 MANAGING DIRECTOR: James Labouchere

NORTH AMERICAN OFFICE (WARRIOR (AERO-MARINE) INC):
 23 Oceanwood Drive, Scarborough, Maine 04074, US
 Tel/Fax: (+1 207) 885 99 20
 e-mail: dverrill@centaureaplane.com
 VICE-PRESIDENT AND DIRECTOR: David C Verrill

Company created in 1995 to develop and market Centaur six-seat amphibian; US subsidiary formed in January 2000 to manufacture and promote aircraft in North American market. Funding acquired by March 2002 from private investors (more than USD3 million). Maine Technology Institute (USD500,000) and UK Department of Trade and Industry (GBP450,000/USD640,000). Fresh design and programme review completed in January 2005. Market estimates from independent US authority updated December 2005.

WARRIOR CENTAUR

TYPE: Six-seat amphibian.

PROGRAMME: First design studies 1992; Mk 1 hull design, and first flight by one-fifth scale model, in 1993; Mk 2 hull configuration developed and trialled 1995; dynamically refined (and still current) one-fifth model first flown 1996; cockpit mockup completed 1997; initial funding by Royal Aeronautical Society Handley Page award. Revealed at Farnborough Air Show, September 1998, when development and planning continuing. Funding for construction and testing of full-size prototype secured 1 September 2001. Prototype, manufactured by Warrior in association with Maine Composites Inc, began in December 2001 and was then expected to fly by end of 2003; however, by then postponed to fourth quarter 2004 (not achieved due to withdrawal of funding pledge). Design changes have included new contours on rear fuselage and outer wings, and deletion of wing bracing struts. Fuselage shipped to company's US facility in October 2003 for installation of systems and power plant. Specifications for military and coast guard search and rescue were proposed in March 2004. Certification to FAR 23 anticipated 24 months after first flight, pending finance or partners.

CUSTOMERS: Five orders by March 2002. Production target is 68 in first full year; 172 in second.

COSTS: Expected to be USD600,000 at 2006 prices and rates. Seat-mile cost estimated at 35 per cent less than comparable amphibians.

Following description applies to full-size aircraft.

DESIGN FEATURES: Concepts proven and refined using CATIA software. Objectives of design included low hydrodynamic drag and structural weight, use of composites materials, folding wing, comfortable operation in coastal wave conditions (0.9 to 1.2 m; 3 to 4 ft wave height), competitive seat-mile costs and payload-range performance, safety, saline impermeability and access to all areas frequented by boats.

Slender boat hull without planing step improves rough-water ride and increases aerodynamic efficiency; parasol-mounted high-lift wing with centrally installed engine nacelle; stub-wing/sponsons with end-mounted floats; conventional tail surfaces. Main panels of wing fold back manually (optionally hydraulically) to within beamwidth of sponsons to permit docking in standard 12 m (40 ft) yacht berths.

FLYING CONTROLS: Conventional and manual. Electrohydraulically actuated, slotted trailing-edge flaps.

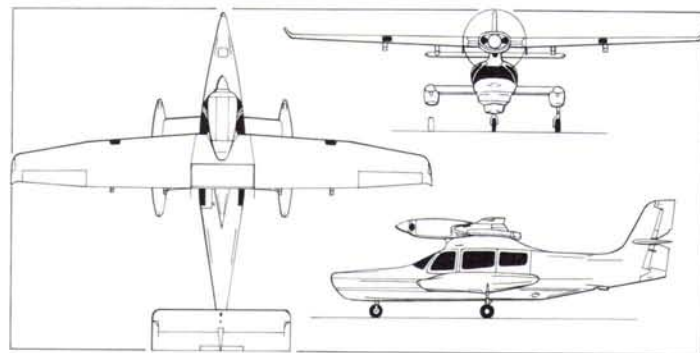
STRUCTURE: Composites construction (carbon and glass fibres). Top surfaces of stub-wings laminated with energy absorbent tread; door sills reinforced with stainless steel.

LANDING GEAR: Electrohydraulically retractable tricycle type in amphibian, nosewheel retracting rearward, mainwheels outward into sponson tip-floats. Landing gear can be omitted in 'pure' seaplane version, with corresponding increase in payload. Stern-mounted 7 kW (9 hp) water-jet for manoeuvring in marine environment.



Gull UAV, based on Centaur technology (Jane's/Patrick Allen)

1149548



General arrangement of the Warrior Centaur amphibian (James Goulding)

0526455

POWER PLANT: One 224 kW (300 hp) Textron Lycoming IO-540-C or 261 kW (350 hp) IO-540-J2B flat-six engine; three-blade, constant-speed, variable-pitch propeller. Further plans include 410 kW (550 shp) PT6A-powered turboprop version. One fuel tank in each sponson; see under Weights and Loadings for details.

ACCOMMODATION: Pilot and one passenger in cockpit; five passenger seats in flying-boat cabin, four in amphibian (forward-facing or club layout). Baggage compartment behind seats. Three doors on port side; two on starboard.

SYSTEMS: Electrically driven hydraulic actuation of wing folding (optional), landing gear (optional) and flaps. Electrical systems powered by 28 V DC alternator and 24 V lead-acid batteries. Air conditioning optional.

AVIONICS: Honeywell APEX 1000 standard; marine HF radio, two-axis autopilot and bow-mounted weather radar.

DIMENSIONS, EXTERNAL:

Wing span	13.65 m (44 ft 9½ in)
Width over sponsons	4.54 m (14 ft 10¼ in)
Length overall	11.15 m (36 ft 7 in)
Height overall, on land	3.78 m (12 ft 4¾ in)
Wheel track	4.09 m (13 ft 5 in)

DIMENSIONS, INTERNAL:

Cabin, excl cockpit: Length	3.81 m (12 ft 6 in)
Max internal load length	4.27 m (14 ft 0 in)
Max width	1.37 m (4 ft 6 in)
Max height	1.22 m (4 ft 0 in)
Volume	3.74 m ³ (132 cu ft)
Baggage compartment volume	1.59 m ³ (56 cu ft)

WEIGHTS AND LOADINGS (A: 300 hp, B: 350 hp engine):

Weight empty: A	1,207 kg (2,661 lb)
B	1,274 kg (2,809 lb)
Baggage capacity	90 kg (200 lb)
Fuel weight: max	354 kg (780 lb)
with max payload	68 kg (150 lb)
Payload: max:	
amphibian	641 kg (1,414 lb)
flying-boat	718 kg (1,583 lb)
with max fuel	264 kg (583 lb)
Max T-O weight from water: A	1,920 kg (4,232 lb)
B	2,100 kg (4,629 lb)

PERFORMANCE (estimated, A and B as above):

Cruising speed:	
at max cruise power at FL50, 75% MTOW: A	127 kt (235 km/h; 146 mph)
B	149 kt (276 km/h; 171 mph)
at recommended cruise power at S/L: A	119 kt (220 km/h; 137 mph)
Stalling speed, power off:	
flaps up: A	51 kt (95 km/h; 59 mph)
flaps down: A	46 kt (86 km/h; 53 mph)
B	48 kt (89 km/h; 56 mph)
Time to FL100: at max cruise power: A	13 min 24 s
B	11 min
T-O run: on water: A	173 m (569 ft)
T-O to 15 m (50 ft): on land: A	286 m (940 ft)
B	289 m (950 ft)
on water: A	362 m (1,190 ft)
B	365 m (1,200 ft)
Landing from 15 m (50 ft) at 1,700 kg (3,748 lb):	
on land: A	348 m (1,140 ft)
Range at max cruising speed, VFR reserves: with max payload:	
A	150 n miles (278 km; 172 miles)
with 545 kg (1,202 lb) (amphibian) or 615 kg (1,356 lb) payload (seaplane):	
A	552 n miles (1,022 km; 635 miles)
B	595 n miles (1,101 km; 684 miles)
with 340 kg (750 lb) payload:	
A and B	1,200 n miles (2,222 km; 1,380 miles)

United States

AAI

AMERICAN AUTOGYRO INC

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The company was formed in December 2002, as a division of Groen Brothers Aviation, designer and builder of larger autogyros, but was merged back into Groen Brothers Aviation on 1 November 2004. AAI's initial objective has been to develop stability augmentation and other safety features for existing autogyros; in February 2003, it began design of its own Sparrowhawk autogyro.

AMERICAN AUTOGYRO SPARROWHAWK

TYPE: Two-seat autogyro ultralight/kitbuilt.

PROGRAMME: Following incremental development on several testbeds, launched at AirVenture, Oshkosh, July 2003, when proof-of-concept vehicle N974J (flown February 2003) was displayed. Kit deliveries then scheduled to begin in late 2003, although stability augmentation kits for gyrocopters already flying were available from April 2003. Factory-complete aircraft also available; law enforcement/aerial patrol conversion (EJ22 engine) (N8069H) first flew in third quarter of 2003.

AAI-built production (N4132R) prototype first flown 25 February 2004. By April 2004, over 1,000 flight hours had been accumulated by the various prototypes; first customer-built kit first flown (in Russia) 23 September 2004.

CURRENT VERSIONS: **Sparrowhawk I:** Initial version, now superseded.

Sparrowhawk II: Current model, as described. Has wider cabin and simpler build process.

Sparrowhawk APV: Airborne patrol vehicle, designed for law enforcement, surveillance and patrol. As Sparrowhawk II; however doors, heating, navigation lights are standard.

CUSTOMERS: Total of 100 sales by January 2006. Dealers appointed in Australia, the Bahamas, Canada, Costa Rica, Ecuador, India, Philippines, South Africa and South Korea by September 2006.

COSTS: Sparrowhawk kit, USD39,500 (2006); Sparrowhawk APV USD62,384, assembled and typically equipped (2004). Operating cost USD20 per hour (2003).

DESIGN FEATURES: Development aircraft based on RAF 2000 pod, but modified substantially with large all-moving rudder and fixed cruciform horizontal stabiliser with endplates. Rudder/stabiliser intersection in line with propeller boss for optimum dynamic stability, assisted by rudder self-centring springs.

Sparrowhawk is unconnected with Canadian RAF company.

FLYING CONTROLS: Dual control sticks for roll and cyclic rotor control; rudder pedals also used for ground steering, in conjunction with differential braking.

STRUCTURE: Aluminium frame with glass fibre pod and honeycomb composites empennage; aluminium keel and mast; tubular steel landing gear; bonded metal rotor blades; carbon composites propeller.

LANDING GEAR: Tricycle type with steerable nosewheel and safety tailwheel; fixed. Cable-operated brakes. All wheels 6.00-6.

POWER PLANT: One reconditioned 119 kW (160 hp) Subaru EJ25 flat-four (new engine in Sparrowhawk APV) driving a two-blade, fixed-pitch, carbon fibre pusher propeller and rotor prerotate drive; dual electronic ignition systems. Fuel capacity 95 litres (25.0 US gallons; 20.8 Imp gallons) of which 87 litres (23.0 US gallons; 19.2 Imp gallons) are usable. Oil capacity 3.3 litres (0.87 US gallons; 0.72 Imp gallons).



American Autogyro Sparrowhawk (Paul Jackson)

1159748

AVIONICS: Bendix/King or Micro-Air equipment to customer's choice.

Instrumentation: AMPtronics Skydat LCD instrument displays for all flight, rotor and engine functions.

DIMENSIONS, EXTERNAL:

Rotor diameter	9.14 m (30 ft 0 in)
Rotor blade chord	0.22 m (8½ in)
Fuselage: Length	3.73 m (12 ft 3 in)
Max width (over landing gear)	1.85 m (6 ft 1 in)
Height: overall	3.05 m (10 ft 0 in)
to top of fuselage	1.90 m (6 ft 3 in)
Wheel track	1.68 m (5 ft 6 in)
Wheelbase	1.46 m (4 ft 9½ in)
Doors (each side): Width	0.91 m (3 ft 0 in)
Height to sill	0.84 m (2 ft 9 in)

DIMENSIONS, INTERNAL:

Cabin: Length	1.60 m (5 ft 3 in)
Max height	1.35 m (4 ft 5 in)
Max width: to sills	1.13 m (3 ft 8½ in)
with doors	1.17 m (3 ft 10 in)

AREAS:

Rotor disc	65.64 m ² (706.5 sq ft)
Vertical tail	1.07 m ² (11.50 sq ft)
Horizontal tail	1.02 m ² (11.00 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	386 kg (850 lb)
Max T-O weight	680 kg (1,500 lb)

PERFORMANCE:

Never-exceed speed (VNE)	86 kt (160 km/h; 100 mph)
Max cruising speed	65 kt (121 km/h; 75 mph)
Max rate of climb at S/L	198 m (650 ft)/min
Service ceiling	3,050 m (10,000 ft)
T-O run	92–153 m (300–500 ft)
T-O to 15 m (50 ft)	305 m (1,000 ft)
Landing from 15 m (50 ft)	92 m (300 ft)
Range at 75% power	245 n miles (453 km; 281 miles)

ABC

AMERICAN BLIMP CORPORATION

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PRESIDENT AND CEO: James Thiele
EXECUTIVE VICE-PRESIDENT: Charles Ehrler
CHIEF ENGINEER: Rudy Bartel

AIRBORNE SURVEILLANCE GROUP:

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OPERATING COMPANY:

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e-mail: info@lightships.com
Web: www.lightships.com
MARKETING DIRECTOR: Toby Page

In 1995, ABC announced the design of a series of airships larger than the A-60, designated A-1-50 (marketing designation A-150). These, now also including the A-170, are a refinement of the earlier A-120 conceptual design with a new technology envelope. The civil version incorporates the ABC internal illumination system for advertising and is designated a Lightship; the non-illuminating surveillance version is designated SPECTOR. Lightship envelopes remain translucent for internal illumination, whereas SPECTOR envelopes are opaque. Each is offered in sizes designed to optimise costs with mission requirements. Other structural elements are identical.

The same envelope technology was introduced as an option for production on existing A-60+ Lightships from 1996 (first contract, for seven envelopes to be supplied by ILC Dover, announced 18 March 1996).

On 23 July 2002, ABC announced that it had acquired the Virgin Lightships interests in the former's affiliate The Lightship Group (TLG), following Virgin's decision to exit the commercial airship market. TLG is now a wholly owned ABC subsidiary, and operates ABC airships around the world.

Company recently stated that it is developing airship designs for medium-altitude (2,000 to 3,000 m; 6,560 to 9,840 ft) operation with military and commercial payloads for surveillance and communications relay. It has also, on behalf of the Jet Propulsion Laboratory, been studying the use of a helium airship as a possible vehicle for unmanned exploration of Titan, the largest of Saturn's moons. Named Aerover, the projected airship would be approximately 10 m (33 ft) long, 2.44 m (8 ft) in diameter and weigh about 100 kg (220 lb). No other details of these new designs had emerged by the fourth quarter of 2006.

In 1999, ABC increased its manufacturing area by 30 per cent with a 410 m² (4,400 sq ft) extension at Hillsboro, which now covers almost 2,325 m² (25,000 sq ft). At the same time, a 280 m² (3,000 sq ft) fabrication shop was being readied at the Tillamook flight test centre. By late 2004, ABC's combined fleet of 18 A-60+/A-1-50/A-170 airships had achieved a cumulative total of nearly 200,000 flight hours.

On 21 November 2000, ABC purchased the type certificate (originally issued on 17 November 1992) for the Colt GA-42 non-rigid helium airship. It is believed that three airships of this type were included in the transfer.

ABC LIGHTSHIP A-60+

TYPE: Helium non-rigid airship.

PROGRAMME: A-50 prototype N5132A registered 31 March 1988 and made first flight 9 April 1988; first flight of production A-60 June 1989; A-60 certified by FAA 18 May 1990 for day/night and VFR/IFR flight; first delivery (to Virgin Lightships Ltd) November 1990; A-60+ certified third quarter 1991 by FAA; APU upgrade certified by FAA, and FLIR Systems Inc gyrostabilised IR camera approved by FAA, in 1993; all A-60s converted to A-60+ in 1993. Certified also in Argentina, Australia, Brazil, Canada, Germany, Italy and

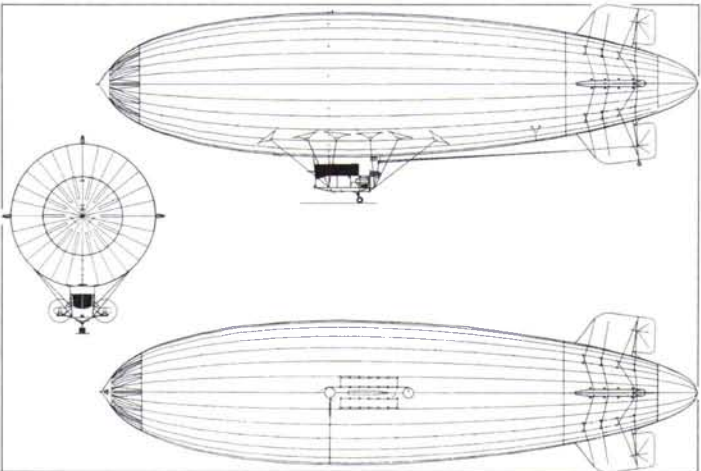
A-60+ PRODUCTION AND LOCATION
(at October 2006)

c/n ¹	Identity	Owner	Location
01	N2012P <i>Snoopy 1</i>	Icarus Aircraft Inc	US
03	N2017A/I-TIRE <i>Spirit of Europe 1/G-TLEL</i>	Lightship Europe	UK
04	N2022B/ZS-ODY/N460LG	Lightship Group	US
05 ³	N560VL <i>Skeeter</i>	Virgin Lightships	US
06	N660VL Van Heusen/PK-	Lightship Group	US
07	N760VL <i>Snoopy 2/N760AB</i>	Icarus Aircraft Inc	Out of service (US)
08	N860AB	Lightship Group	Out of service (Brazil)
09	N960AB	Beijing Orient	Out of service (US)
010	N3119W/VH-ZIC <i>Spirit of the South Pacific/N610LG</i>	Lightship Group	US
011	N112P	Lightship Group	Out of service (US)
012	N12ZP <i>Spirit of Europe 2/IA12ZP</i>	Virgin Lightships	Japan
014	N614LG/PT-MKJ <i>Spirit of the Americas/N614LG</i>	Lightship America	US
015 ³	N615LG	Lightship Group	US
016	N606LG/G-OLEL/China	Lightship Europe	UK
017	N607LG <i>Horizon</i>	Icarus Aircraft Inc	US
018	N618LG	Lightship Group	US
019-023	N619LG-N623LG ²	ABC	US

¹ 02 and 013 not built
² Reservations only; not completed by late 2006
³ Converted to A-60R



Lightship A-60+ advertising airship 0558597



ABC Lightship A-60+ (Paul Jackson) 0568971

South Africa; approved for operation in China, Japan and Turkey. Airship 05 reached 10,000 flight hours on 28 October 1999, and two others had achieved this total by February 2000. A Lightship Group two-man British crew in 016/N606LG set a new FAI Class BA absolute world speed record for gas airships on 19 January 2000, reaching 50.11 kt (92.80 km/h; 57.66 mph) over a 1 km course.

One A-60+ loaned by The Lightship Group was used in January 2000 for UK-based flight trials fitted with a DERA (now QinetiQ) Mineseeker ultra-wideband, ground-penetrating radar for detection of undersurface metal and plastics mines. Subsequently, after the addition of a Wescam I6DS-M dual-sensor (daylight TV and FLIR) payload, this airship conducted a six-week programme (4 October to 14 November 2000) from bases in Italy and Kosovo, surveying 30 sites in the latter locality for mines and other unexploded ordnance on behalf of the United Nations Mine Action Co-ordination Centre (UN MACC). As a result of the success of this operation, a Mineseeker Foundation was set up as a joint venture with DERA/QinetiQ which, in April 2001, announced plans to raise GBP10 million to purchase five similarly equipped airships. No such orders had been announced by November 2006.

CURRENT VERSIONS: **A-60:** Initial production version. All since converted to A-60+.

A-60+: Current version from 1991; larger envelope; payload increased by 181 kg (400 lb) compared with A-60; Lightsign message board option from 1992. Also offered in **SPECTOR 19** form (which see).

Description applies to A-60+.

A-60R: Conversion of A-60+ with Rotax engines. Two by 2006 (registered as 'A60R').

CUSTOMERS: Total of 21 registered by 1998 (see table); of these 018 made its first flight 4 August 2000; none further by late 2006, thus 16 completed. 01 badly damaged by storm on 7 September 2001 and may not have been repairable.

DESIGN FEATURES: Conventional-shape envelope; cruciform tail surfaces; gondola suspended by 12 catenary cables each attached to external patches, eliminating need for internal cables,

gastight fittings and bellow sleeves. Can be inflated without a net by attaching ballasted gondola before adding helium; gondola can be removed from inflated Lightship without a net by ballasting catenary cables.

FLYING CONTROLS: Single internal ballonet; rudder or elevator on each of four tailfins; primary flight controls for left-hand front seat only.

STRUCTURE: Outer envelope skin of Dacron/Mylar with separate urethane film inner gastight bladder and single ballonet. All structural attachments to sewn outer bag, such as nose mooring, fin base and guy wires, car catenary and handling lines, made with webbing reinforcements sewn directly to envelope.

LANDING GEAR: Single twin-wheel unit beneath gondola; small tailwheel at base of lower vertical fin. Operating area diameter required: 229 m (750 ft).

POWER PLANT: Twin 59.7 kW (80 hp) Limbach L 2000 engines, pusher-mounted to enhance propulsive efficiency and reduce noise. Standard capacity of rear-mounted fuel tank is 280 litres (74.0 US gallons; 61.6 Imp gallons); can be refuelled in the field without mooring.

ACCOMMODATION: Two single seats and rear bench seat in gondola (pilot plus three adult passengers or two adults and two small children.) Ground crew of 13.

SYSTEMS: 28 V 70 A electrical system with two 28 V 35 A alternators. APU capable of delivering 2.5 kW at 110 V certified December 1993 and now standard. Used mainly to power internal illumination lights, but can also be used for other airborne equipment.

EQUIPMENT: Two 1 kW bulbs for internal illumination system. Certified for gyrostabilised TV or IR camera mount, complete with microwave downlink for live broadcast; can be operated simultaneously with APU.

DIMENSIONS, EXTERNAL:

Overall: Length 39.01 m (128 ft 0 in)
Width 10.97 m (36 ft 0 in)
Height 13.41 m (44 ft 0 in)
Envelope: Length 39.01 m (128 ft 0 in)
Max diameter 10.01 m (32 ft 10 in)
Fineness ratio 3.9

Advertising banner areas:

Each side: Length 27.43 m (90 ft 0 in)
Max depth 6.10 m (20 ft 0 in)
Underside, forward:

Length 6.10 m (20 ft 0 in)
Width 7.62 m (25 ft 0 in)
Gondola: Length 3.96 m (13 ft 0 in)
Width 1.52 m (5 ft 0 in)
Height (incl landing gear) 2.90 m (9 ft 6 in)
Propeller diameter 1.52 m (5 ft 0 in)

DIMENSIONS, INTERNAL:

Envelope volume 1,926 m³ (68,000 cu ft)
Gondola: Cabin length 2.68 m (8 ft 9½ in)
Cabin height 1.93 m (6 ft 4 in)

AREAS:

Tailfins (four, total) 42.74 m² (460.0 sq ft)

WEIGHTS AND LOADINGS:

Total weight empty 1,393 kg (3,070 lb)
Max buoyancy 1,814 kg (4,000 lb)
Max dynamic lift 113 kg (250 lb)
Max useful lift, ISA at 660 m (2,000 ft) 680 kg (1,500 lb)
Max gross weight 1,993 kg (4,394 lb)

PERFORMANCE:

Max level speed 47 kt (88 km/h; 55 mph)
Cruising speed 28 kt (51 km/h; 32 mph)
Max rate of ascent 488 m (1,600 ft)/min
Service ceiling 2,225 m (7,300 ft)
Max rate of descent 396 m (1,300 ft)/min
Min T-O distance 112 m (366 ft)
Max range at 28 kt (51 km/h; 32 mph) 425 n miles (787 km; 489 miles)
Max endurance at 28 kt (51 km/h; 32 mph) 15 h

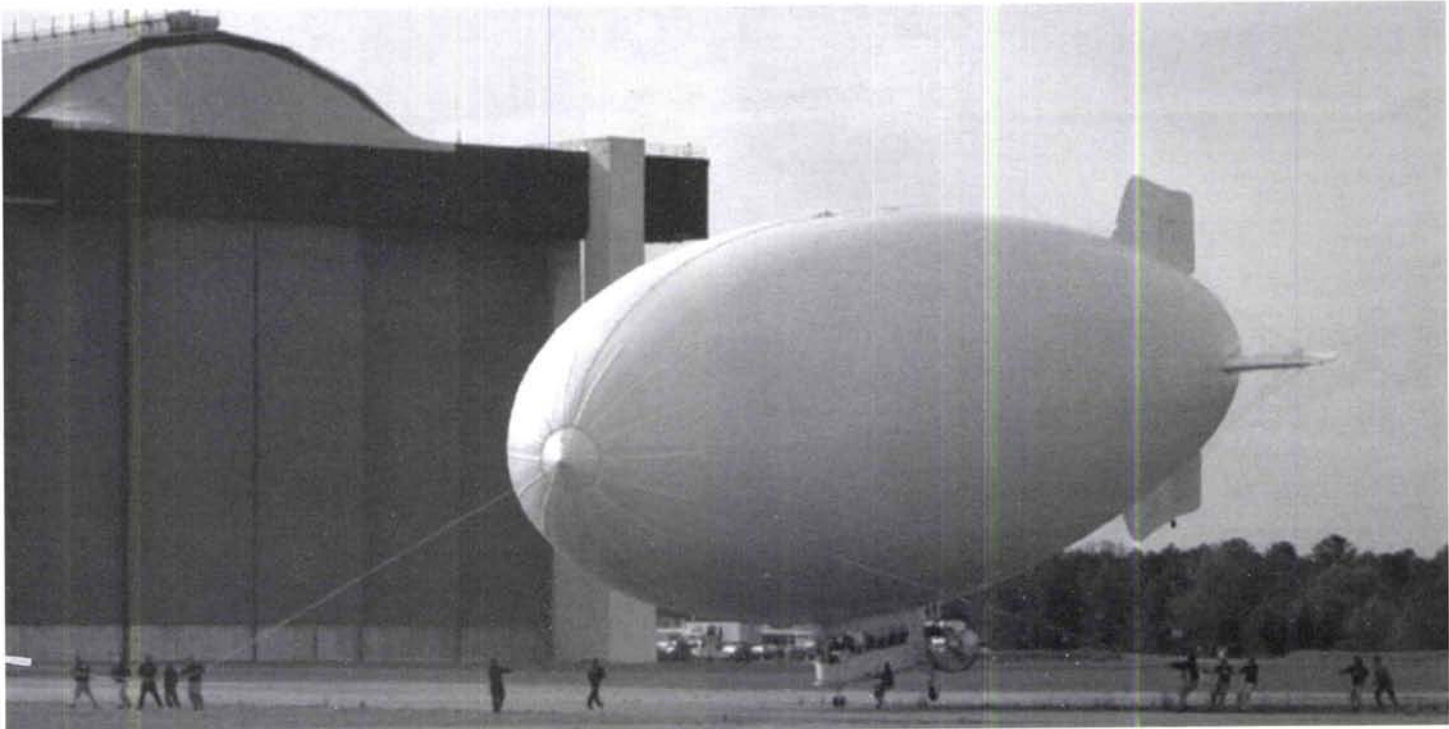
ABC LIGHTSHIP/SPECTOR SERIES

US Navy designation: MZ-3A

TYPE: Helium non-rigid airships.

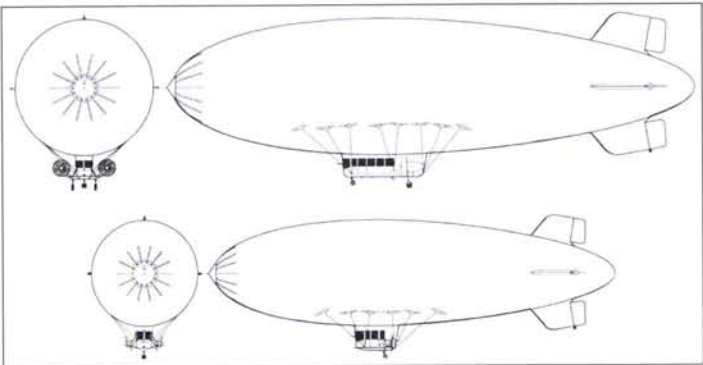
PROGRAMME: Three envelope sizes offered for both civil and surveillance versions; SPECTOR name applies to surveillance versions. First to be built, a Lightship A-1-50 (N5132A, c/n 001), made its first flight on 8 January 1997. FAA type certificate issued 3 October 1997, at which time a total of 683 hours had been flown; 10,000-hour milestone passed in early 2004. Marketing designations are A-150 and A-170; designation on Type Certificate and registration documents of current version is A-1-50.

On 13/14 September 2004, an A-150 (N155LG) piloted by Carl Harbuck and Douglas McFadden established (subject to FAI confirmation) a new world class duration record of 24 hours 39 minutes 55 seconds, breaking six classes of endurance record for non-



ABC MZ-3A (A-1-70) being manoeuvred at Lakehurst (US Navy)

1040434



Comparative views, to scale, of the Lightship A-1-50 (top) and A-60+ (Paul Jackson)

0507571

pressurised gas airships of more than 3,000 m³ (105,950 cu ft) and exceeding the previous record by more than 10 hours. Some 125 litres (33.0 US gallons; 27.5 Imp gallons) of fuel - enough for more than three additional hours' flying - remained at the end of the flight.

CURRENT VERSIONS: **Lightship A-60+/SPECTOR 19:** See A-60+ entry.

Lightship A-1-50/SPECTOR 42: Initial production version; as described.

Lightship A-170/SPECTOR 48: First flight 13 May 2004 (N156LG). One completed and two others nearing completion by early November 2004. First example took part in late September and early October 2004, in a week-long joint ABC/ARINC demonstration on behalf of the Joint Land Attack Cruise Missile Defense Elevated Netted Sensor (JLENS) Project Office that included a 24-hour endurance flight over the Pentagon and support of a joint force protection mission. Equipment on board included Rapid Aerostat Initial Deployment System (RAIDS) surveillance cameras and sensors of the type used in support of troops in Afghanistan and Iraq. ARINC has proposed an unmanned version for a similar role.

MZ-3A: One A-170 acquired by US Navy under USD3.5 million contract from Office of Naval Research; operated from NAS Lakehurst, New Jersey (initial test sortie 2 May 2006) as research platform testing sensors and other equipment for use in manned aircraft and UAVs. Designation MZ-3A adopted 17 August 2006.

Lightship A-170 Video Lightsign: Version with 21.34 × 9.14 m (70 × 30 ft) LED screen on envelope, developed by High-Tech Electronic Displays Inc, to display full-colour live video at 128 × 240 pixel resolution. Video is captured by a FLIR Systems Ultramedia camera mounted on the A-170 and sent via a laptop PC to the 408 kg (900 lb), 3.8 cm (1½ in) thick screen. First example leased for 1 year in August 2006 to Australian company G M Holden, following receipt of FAA approval in April 2006. Manufacture of a second example was due to begin in August 2006.

CUSTOMERS: Seven A-1-50s and at least three A-170s completed by November 2006; see table. COSTS: SPECTOR 42 approximately USD3.5 million (2002).

DESIGN FEATURES: As described for A-60+; larger gondola; also seat tracks for quick reconfiguration of cabin; water ballast trim system.

FLYING CONTROLS: Standard as for A-60+; dual controls and autopilot optional. Trimming with ballonet accomplished by transferring water to the nosecone tank from the main tank in the rear portion of the gondola. Certified for day/night, VFR/IFR, single-pilot operation.

STRUCTURE: Single-walled ILC Dover envelope with single (26 per cent of volume) ballonet; Tedlar outer film plus inner ripstop fabric/helium barrier film laminated material with heat-sealed seams. Envelopes translucent on Lightship versions, opaque for SPECTOR; those for SPECTOR series have carbon black in the material for ease of maintenance. Control surfaces and fins of fabric-covered aluminium; gondola of aluminium and fabric-covered steel tubing.

LANDING GEAR: Non-retractable tricycle type. Spring-damped main units each with single wheel and tyre; slightly raised nose unit with twin wheels/tyres; small tailwheel at base of lower vertical fin. Required operating area diameter: 305 m (1,000 ft).

POWER PLANT: **SPECTOR 42 and 48:** Two 134 kW (180 hp) Textron Lycoming IO-360-B1G6 flat-four engines, each driving an MTV-25-B-C five-blade constant-speed, reversible-pitch tractor propeller. Rear-mounted fuel tank, standard capacity 560 litres (148 US gallons; 123 Imp gallons). Airship can be refuelled in the field without mooring.

ACCOMMODATION: Single seats for pilot and co-pilot (optional) or passenger on flight deck; five single seats and a three-person bench seat in main cabin. Lavatory and galley optional. Door on port side, aft of pilot station; emergency exit opposite on starboard side. Ground crew of 10 to 12.

SYSTEMS: Electrical system is 28 V DC, with two 90 A alternators; additional 2.5 kW/110 V at 60 Hz available from removable APU.

AVIONICS: Primary suite from Bendix/King Silver Crown range, including:

Comms: KY 196 com, KT 76A transponder and KMA 24H audio panel.

Flight: KX 155 nav/com and Apollo 820 GPS receiver.

EQUIPMENT: Two 1 kW bulbs for internal illumination system. Gyrostabilised camera mount, as in A-60+. Gondola hardpoint provisions for external installation of a variety of sensor equipment. Standard seat tracks in main cabin facilitate sensor/electronics rack installations.

DIMENSIONS, EXTERNAL (A: A-1-50/SPECTOR 42, B: A-170/SPECTOR 48):

Overall: Length: A	50.29 m (165 ft 0 in)
B	53.64 m (176 ft 0 in)
Width: A, B	14.02 m (46 ft 0 in)
Height: A, B	16.76 m (55 ft 0 in)
Envelope: Length: A	49.38 m (162 ft 0 in)
B	52.73 m (173 ft 0 in)
Max diameter: A, B	13.11 m (43 ft 0 in)
Fineness ratio: A	3.8
B	4.0
Advertising banner areas:	
Each side: Length	35.97 m (118 ft 0 in)
Max depth	8.53 m (28 ft 0 in)
Underside, forward:	
Length	8.53 m (28 ft 0 in)
Width	9.75 m (32 ft 0 in)
Gondola: Length: A, B	8.08 m (26 ft 6 in)
Max width: A, B	6.25 m (20 ft 6 in)
Max height: A, B	3.35 m (11 ft 0 in)
Propeller diameter: A, B	1.68 m (5 ft 6 in)
DIMENSIONS, INTERNAL:	
Envelope volume: A	4,248 m ³ (150,000 cu ft)
B	4,814 m ³ (170,000 cu ft)

A-1-50 PRODUCTION AND LOCATION
(at October 2004)

c/n	Identity	Owner	Location
101	N151AB	Lightship Group	US
102	N152LG/N151LG Bud I/PR-ANA	Lightship Group	Brazil
103	N153LG/TC-AVK	KOC Holdings	Out of service
104	N154ZP	(destroyed 22 May 2004)	
105	N155LG <i>Trumpasaurus</i>	Lightship Group	US
106	N156LG	Virgin Lightships	US
107	N157LG	US Navy	US

Ballonet volume: A	1,104 m ³ (39,000 cu ft)
B	1,257 m ³ (44,387 cu ft)
Gondola:	
Cabin overall length:	
A, B	4.79 m (15 ft 8½ in)
Main cabin length: A, B	4.27 m (14 ft 0 in)
Average cabin width: A, B	1.52 m (5 ft 0 in)
Cabin height: A, B	1.93 m (6 ft 4 in)
WEIGHTS AND LOADINGS:	
Total weight empty: A	2,860 kg (6,305 lb)
B	2,897 kg (6,387 lb)
Max payload: A	663 kg (1,461 lb)
B	993 kg (2,189 lb)
Max buoyancy: A	4,055 kg (8,939 lb)
B	4,595 kg (10,131 lb)
Max dynamic lift: A, B	340 kg (750 lb)
Max useful lift at 656 m (2,000 ft), ISA:	
A	1,633 kg (3,600 lb)
B	2,253 kg (4,967 lb)

Max T-O weight: A	4,394 kg (9,689 lb)
B	4,981 kg (10,981 lb)
PERFORMANCE (B: estimated):	
Max level speed: A	52 kt (96 km/h; 59 mph)
B	50 kt (92 km/h; 57 mph)
Cruising speed: A	40 kt (74 km/h; 46 mph)
Max single-engine speed: A	33 kt (61 km/h; 38 mph)
B	31 kt (57 km/h; 35 mph)
Max rate of ascent: A, B	488 m (1,600 ft)/min
Max rate of descent: A	488 m (1,600 ft)
B	427 m (1,400 ft)
Service ceiling: A, B	3,050 m (10,000 ft)
Max rate of descent: A	488 m (1,600 ft)/min
Max range at 35 kt (65 km/h; 40 mph):	
A	534 n miles (990 km; 615 miles)
B	437 n miles (811 km; 503 miles)
Max endurance at 35 kt (65 km/h; 40 mph):	
A, B	approx 15 h

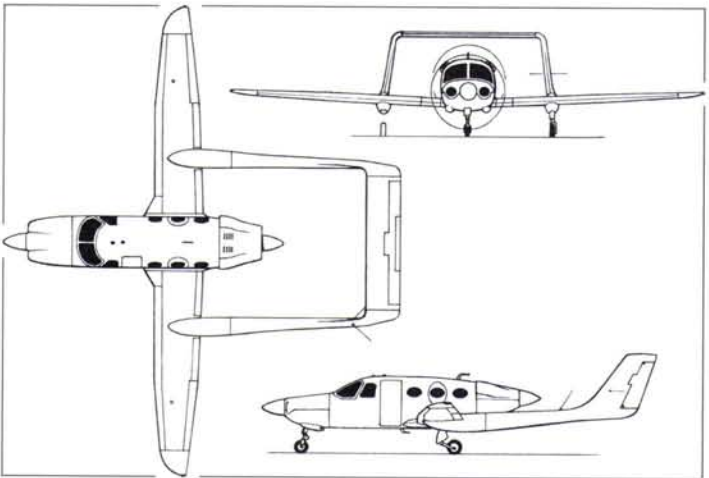
ADAM

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PRESIDENT: John C Knudsen
EXECUTIVE VICE-PRESIDENT: Chris Finnoff
VICE-PRESIDENTS:
Richard Boone (Manufacturing and Test Engineering);
Matthew Kull (Operations);
Bill Mermelstein (Propulsion);
Dennis Olcott (Design Engineering);
Mike Smith (Finance);
Tom Wiesner (Flight Operations);
Rob Penrod (Manufacturing);
Joe Wilding (Advanced Development)
CHIEF FINANCIAL OFFICER: Chris Naro

Adam Aircraft Industries formed in 1998 and is building the A500 centreline-thrust twin-engine business aircraft at its 9,848 m² (106,000 sq ft) Englewood and the A700 twin-engined business jet derivative, in a 2,044 m² (22,000 sq ft) facility at Kemp Ogden Airport Gateway Centre, Utah. Additional 3,716 m² (40,000 sq ft) component fabrication plant is located in Pueblo, Colorado. By mid-2000 the workforce numbered 12 but had risen to 72 by October 2001 and 540 by April 2006.
Having designed its own seats for the A500, Adam has begun an auxiliary business as a seat producer to the aerospace industry.

ADAM A500

TYPE: Business twin-prop.
PROGRAMME: Designed by Burt Rutan, with designation M-309 denoting his 309th aircraft design; development started September 1999; proof-of-concept aircraft (N309A), manufactured by Scaled Composites Inc, first flown at Mojave, California, 21 March 2000; formally rolled out 5 April 2000; total of 80 flight hours completed by the time of public debut at EAA AirVenture 2000 at Oshkosh in July 2000 and 155 hours by EAA AirVenture 2001; second aircraft, designated A500, and in proposed production configuration, first flew (N500AX) 11 July 2002 at Centennial Airport, Denver. First production fuselage, completed January 2002, used for promotional display; three conforming production aircraft participating in FAA FAR Pt 23 IFR certification, using FAA's Certification Process Improvement programme including flight into known icing; no carry-forward certification from M-309 trials, and this aircraft had been withdrawn from use by mid-2002. Second A500 prototype (N501AX, first with winglets,) flew 18 February 2003; third prototype (N502AX) flew 12 December 2003; FAA type inspection authorisation received, 30 September 2004; sixth airframe, first destined for customer, rolled out 10 October 2004, becoming N522EA, c/n 005 and delivered to a customer from Colorado Springs on 7 November 2005 during the NBAA Convention in Orlando, followed by delivery of the second customer aircraft, c/n 006, on 5 December 2005; and third, c/n 007, on 25 May 2006. Day VFR certification awarded by FAA on 11 May 2005, Night/IFR, pressurisation, altitude expansion and de-icing approvals achieved 28 September 2006.
CURRENT VERSIONS: **M-309:** Original proof-of-concept model, described in 2002-03 *Jane's*.



Adam A500 business twin-prop prior to addition of winglets
(Michael Badrocke)

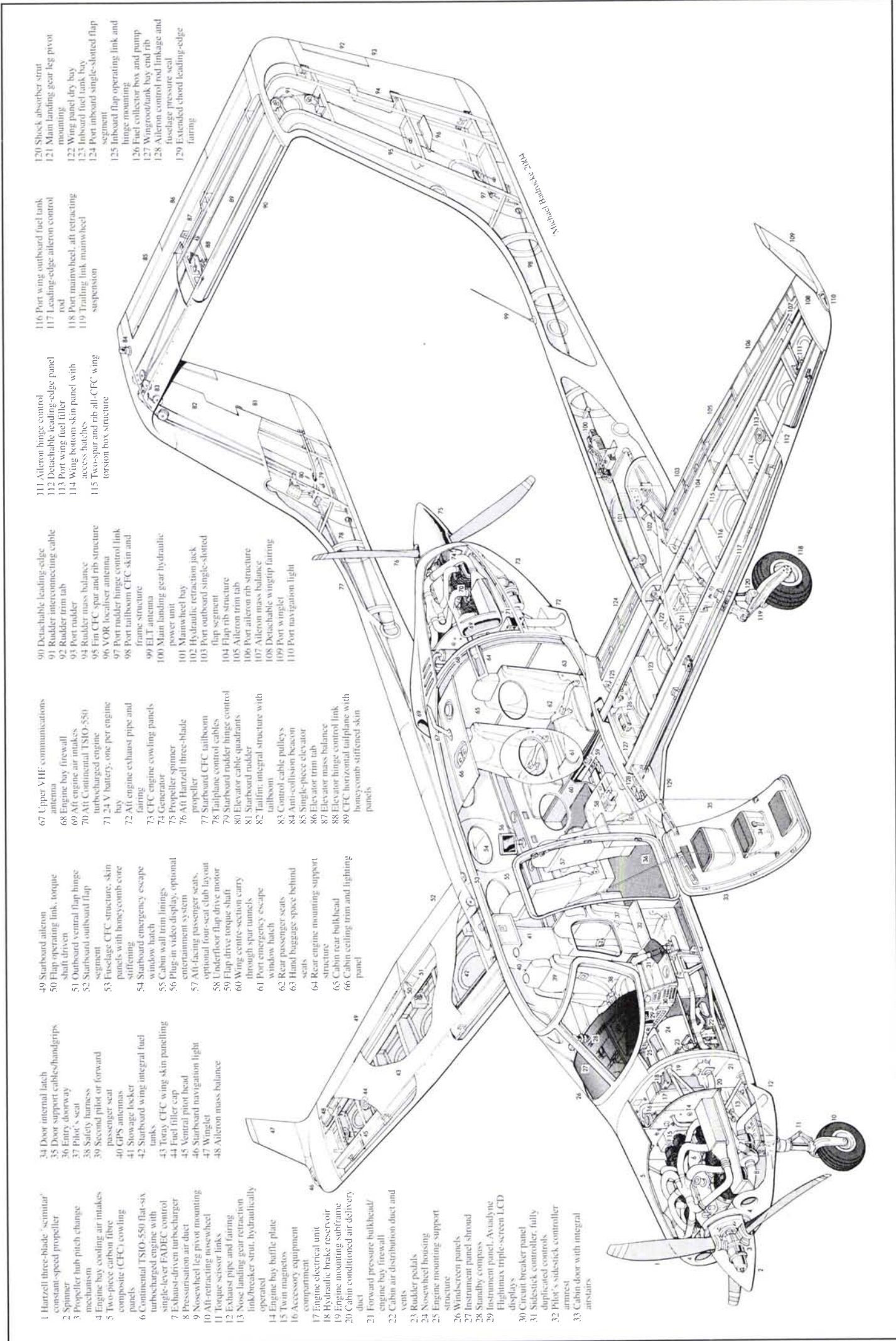
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A500: Production version with changes to wing span, length, flying controls and door positioning; as described.
A family of aircraft, ultimately stretched to seat 19 passengers, is planned.
CUSTOMERS: Total 70 sold to private owners by October 2006, plus unspecified number within 276 A500/A700s sold to air taxi and managed/shared fleets.
COSTS: Unit cost USD1.2 million (2005). Direct operating cost USD274/h (2005).
DESIGN FEATURES: Twin-boom configuration with swept fins and high-set tailplane; unswept low wings have dihedral on outboard panels and small winglets. Tractor/pusher power plant simplifies handling with single engine failure.
FLYING CONTROLS: Conventional and manual. Flaperons of M-309 replaced by separate ailerons and Fowler flaps. Trim tab in each aileron (flight adjustable). Full-width elevator with tab and external mass balance. Twin rudders have no tabs. No flaps on proof-of-concept aircraft; production aircraft will have separate flaps.
STRUCTURE: Single-cure graphite carbon composite with no secondary bonds or fasteners. Proof-of-concept aircraft has three-spar main wing spar, but production aircraft will have a single-piece spar, with wing mounted lower than on POC aircraft to minimise spar carry-through in cabin. Wing attached by four bolts to fuselage.
LANDING GEAR: Retractable tricycle type, with single wheel on each unit; trailing link suspension on main units. All wheels retract rearwards; mainwheels 6.00-6, nosewheel 15x6.0-6. Hydraulic brakes.
POWER PLANT: Two 261 kW (350 hp) Teledyne Continental TSIO-550-E flat-six piston engines, with optional TCM/Aerosance FADEC, mounted in centreline thrust configuration and driving a three-blade Hartzell FC7663D-2R scimitar-bladed propeller at the front and a three-blade Hartzell FLC7663DF-2RX at rear. Fuel capacity 946 litres (250 US gallons; 208 Imp gallons) in outer wing tanks of which 871 litres (230 US gallons; 192 Imp gallons) are usable.
ACCOMMODATION: Pilot and five passengers in pressurised cabin on three pairs of leather seats. Door with integral airstair on port side, ahead of wing leading edge; emergency window on each side. Integrated ventral baggage pod optional.



Adam A500 company demonstrator (Paul Jackson)

1159166



Adam A500, cutaway drawing key

0581425



Adam A500 interior 0589402

SYSTEMS: Pressurisation system maintains a 2,440 m (8,000 ft) cabin environment at 7,620 m (25,000 ft). Vapour-cycle air conditioning system. Optional TKS liquid de-icing system for wing and tailplane leading-edges; windscreen and propeller have electrically heated de-icing.

AVIONICS: *Comms:* Dual Garmin GNS 430 GPS/NAV/COM/ILS, Garmin GMA 340 audio panel and Garmin GTX 327 transponder, all standard; GTX 330 transponder, GDL 49 WX Datalink transceiver, and Aircell AST Iridium 3500 satcom with wireless handset, optional. *Radar:* Weather radar in wing-mounted pod optional.

Flight: S-Tec System FiftyFive X autopilot standard; L-3 Comm WX-500 Stormscope and Skywatch, and Ryan 99009 BX TCAD, optional.

Instrumentation: Avidyne FlightMax Integra system comprising two 26 cm (10.4 in) diagonal, high-resolution, sunlight-readable screens, one each for MFD and PFD functions, each incorporating ADAHRS, EADI and EHSI functions; dual Vision Microsystems VM1000 EMS.

DIMENSIONS, EXTERNAL:

Wing span	13.41 m (44 ft 0 in)
Wing aspect ratio	10.9
Length overall	11.18 m (36 ft 8 in)
Height overall	2.90 m (9 ft 6 in)
Wheel track	3.57 m (11 ft 8½ in)
Wheelbase	3.08 m (10 ft 1¼ in)
Propeller diameter	1.93 m (6 ft 4 in)

DIMENSIONS, INTERNAL:

Cabin: Length	4.15 m (13 ft 7¼ in)
Max width	1.37 m (4 ft 6 in)
Max height	1.29 m (4 ft 3 in)
Volume	7.4 m³ (262 cu ft)

AREAS:

Wings, gross	15.33 m² (165.0 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	2,341 kg (5,160 lb)
Max fuel weight	585 kg (1,290 lb)
Max T-O weight	3,175 kg (7,000 lb)
Max ramp weight	3,198 kg (7,050 lb)
Max wing loading	207.1 kg/m² (42.42 lb/sq ft)
Max power loading	6.09 kg/kW (10.00 lb/hp)

PERFORMANCE:

Max level speed at FL220	250 kt (463 km/h; 288 mph)
Cruising speed at 75% power at FL220	230 kt (426 km/h; 265 mph)

Econ cruising speed at 60% power at FL220	200 kt (370 km/h; 230 mph)
Stalling speed, flaps and landing gear down	75 kt (139 km/h; 87 mph)
Service ceiling	7,620 m (25,000 ft)
Service ceiling, OEI	4,877 m (16,000 ft)
Max rate of climb at S/L	417 m (1,368 ft)/min
Rate of climb at S/L, OEI	69 m (227 ft)/min
T-O run	630 m (2,068 ft)
T-O to 15 m (50 ft)	753 m (2,471 ft)
Landing run	554 m (1,818 ft)
Landing from 15 m (50 ft)	753 m (2,471 ft)
Range with max fuel, NBAA IFR reserves:	
at max cruising speed	1,050 n miles (1,944 km; 1,208 miles)
at econ cruising speed	1,150 n miles (2,129 km; 1,323 miles)

ADAM A700 ADAMJET

TYPE: Light business jet.

PROGRAMME: Announced on 21 October 2002; first flight of the proof of concept prototype (N700JJ, later N700AJ) 27 July 2003, followed by public debut at EAA AirVenture, Oshkosh, 29 July 2003. Fitted with ventral fuel tank in early 2005.

Construction of two additional test and certification aircraft began in 2005. No. 2 built from A500 c/n 009 as A700 c/n 002/N700LJ, first flown 6 February 2006. Second prototype differs from c/n 001 in having its engine mounts moved aft for turbine burst protection; larger baggage and maintenance access doors; revised window and emergency exit locations; revised lavatory location on port side of rear cabin, and a three-tube EFIS flight deck. Three static and fatigue test airframes also used in the test programme, scheduled to culminate in FAA certification to FAR/JAR 25 in fourth quarter of 2006. By late April 2006 the two flying prototypes had jointly logged more than 500 flight hours and the performance envelope had been expanded to 340 kt (630 km/h; 391 mph) and FL410.

CUSTOMERS: Total of 286 ordered by April 2006, including 75 for launch customer air taxi operator Pogo, 61 for private buyers, and 150 for undisclosed fractional ownership operator.

COSTS: USD2.25 million. Direct operating cost USD350 per hour (both 2006).

DESIGN FEATURES: Design draws on A500 using wings (but with thicker main spar), booms, tailplane, fins, cockpit and landing gear for some 65 per cent parts commonality. Engines pylon-mounted at rear of fuselage.

FLYING CONTROLS: Similar to A500. Twin tabs in elevator and on one rudder. Two-section flaps (inboard and outboard of boom) on each wing.

STRUCTURE: Monocoque fuselage of carbon fibre composites with honeycomb stiffening. Two-spar wing with integral fuel tank.

LANDING GEAR: Generally as A500; mainwheels 6.50–8; nosewheel 6.00–6.

POWER PLANT: Two Williams International FJ33-4A turbopfans, each derated to 5.34 kN (1,200 lb st) from nominal 6.83 kN (1,536 lb st). Fuel capacity (production) 1,249 litres (330 US gallons; 275 Imp gallons) in wing and fuselage ventral tanks.

ACCOMMODATION: One or two pilots in cockpit, plus four passengers in club seating plus one to rear on starboard side in owner/operator configuration, or six passengers, all in forward-facing seating, in air taxi configuration, in cabin, separated by divider and refreshment centre. Integral airstair on port side ahead of wing leading edge, with emergency exits on both sides of fuselage at rear of cabin. Lavatory to rear of club seats on starboard side in owner/operator configuration. Baggage compartment in nose, forward of pressure bulkhead, accessible externally. Second baggage compartment at rear of cabin. Accommodation is pressurised and air conditioned.

SYSTEMS: As A500, but with de-icing protection for wing, horizontal tail, windscreen and engine inlets with known icing certification. Dual 200 Ah starter-generators; dual bus electrical system with separate bus for emergency operation. Pressurisation system, maximum pressure differential 0.57 bars (8.33 lb/sq in), maintains a sea level cabin environment to 3,780 m (12,400 ft) and a 2,440 m (8,000 ft) cabin altitude to 12,500 m (41,000 ft).

AVIONICS: Avidyne FlightMax Integra II integrated avionics with three-tube EFIS comprising two PFDs and one MFD.

All data are provisional.

DIMENSIONS, EXTERNAL:

Wing span	13.41 m (44 ft 0 in)
Length overall	12.42 m (40 ft 9 in)
Height overall	2.92 m (9 ft 7 in)

DIMENSIONS, INTERNAL:

Cabin (between pressure bulkheads):	
Length	4.88 m (16 ft 0 in)
Max width	1.37 m (4 ft 6 in)
Max height	1.31 m (4 ft 3½ in)
Volume	6.9 m³ (245 cu ft)
Baggage hold volume: front	0.85 m³ (30.0 cu ft)

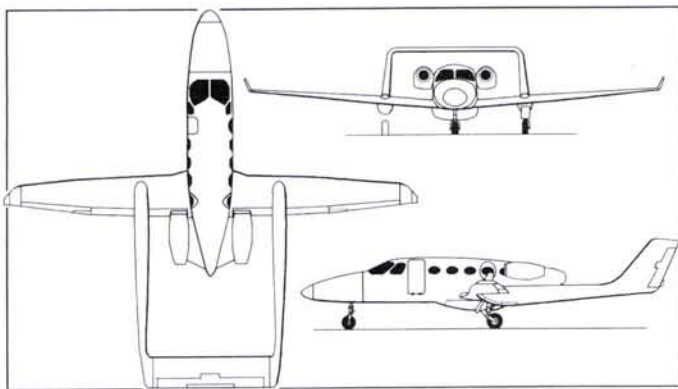
WEIGHTS AND LOADINGS:

Basic operating weight	2,204 kg (4,860 lb)
Max fuel	1,003 kg (2,211 lb)
Max T-O weight	3,447 kg (7,600 lb)



Second Adam A700 more closely resembles production configuration (Paul Jackson)

1159169



Adam A700 AdamJet business jet (Paul Jackson)

1159122

ADI

ADI

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 e-mail: aircraft@mbay.net
 Web: www.aircraftdesigns.com
 PRESIDENT: Martin Hollmann
 CHIEF AERODYNAMICIST: Rick McWilliams

This company produces kits for the Hollmann-designed Stallion; sells plans for the Hollmann HA-2M Sportster and Hollmann Bumble Bee gyrocopters (see 1992-93 *Jane's All the World's Aircraft*, Private Aircraft section); and is a major contributor to the Lancair series of kitbuilt aircraft (which see), as well as others including Seawind, Pulsar Sport 150, Prowler, Condor and Rans Courier. Also provides aircraft conceptual design and analysis. Covered plant area is 560 m² (6,025 sq ft) and full-time employees numbered two in 2005.

ADI SUPER STALLION

TYPE: Six-seat kitbuilt.

PROGRAMME: Construction of prototype began in 1990; first flew (N408S) July 1994.

CURRENT VERSIONS: **Super Stallion:** As described.

Turbine Stallion: One aircraft fitted with Walter M601 turboprop by Turbine Design of Deland, Florida.

CUSTOMERS: Seven production aircraft registered by mid-2006; 54 kits sold by July 2001 (latest data supplied) including one to New Zealand; five on US civil register by September 2006.

COSTS: USD98,225 (2006) excluding engine, instruments and avionics; estimated costs to first flight USD141,000-196,000 depending on engine choice.

DESIGN FEATURES: High-performance tourer for amateur construction. Designed to FAR Pt 23. Extensive use of composites. Employs Lancair IV wings and landing gear. Wing easily removed for storage and transportation. Winglets introduced from 2000. Quoted build time 1,500 hours.

Laminar flow, cantilever wing with 2" washout at tip. Wing section NACA 64-212 at tip, Jacobsy RXM5-217 at root. Optional winglets.

FLYING CONTROLS: Conventional and manual. Flight-adjustable tab in port elevator; horn-balanced rudder with ground-adjustable tab. Fowler flaps droop to 30° and are 2.84 m (9 ft 4 in) long. Aileron length 1.78 m (5 ft 10 in).

Max landing weight	3,356 kg (7,400 lb)
Max ramp weight	3,470 kg (7,650 lb)
Max zero-fuel weight	3,175 kg (7,000 lb)
Payload with max fuel	329 kg (725 lb)
Fuel with max payload	295 kg (650 lb)
Max power loading	323 kg/kN (3.17 lb/lb st)

PERFORMANCE:

Max cruising speed at FL350	340 kt (630 km/h; 391 mph)
Service ceiling	12,500 m (41,000 ft)
Service ceiling OEI	9,140 m (30,000 ft)
Max rate of climb, OEI	165 m (540 ft)/min
T-O run	899 m (2,950 ft)
Range, 45 min reserves:	
IFR	1,100 n miles (2,037 km; 1,265 miles)
VFR	1,400 n miles (2,592 km; 1,611 miles)

STRUCTURE: Prebuilt centre-fuselage area of welded 4130 steel tubing; remainder of airframe primarily of graphite/Nomex honeycomb core/epoxy.

LANDING GEAR: Tricycle type; retractable. Hydraulic power is provided by an electric motor. Cleveland 6.00-6 mainwheels and tyres; nosewheel 5.00x5. Hydraulic disc brakes.

POWER PLANT: Choice of either 224 kW (300 hp) Teledyne Continental IO-550-G or 261 kW (350 hp) turbocharged Teledyne Continental TSIO-550-B six-cylinder engine driving a McCauley or Hartzell three-blade constant-speed propeller. Fuel capacity 681 litres (180 US gallons; 150 Imp gallons) in two wing tanks. Other engine options include 268 kW (360 hp) Textron Lycoming TIO-540-AE2A, 560 kW (751 shp) Walter M 601E and reconditioned 410 kW (550 shp) PT6A-20.

ACCOMMODATION: Two pilots and up to four passengers in three pairs of seats. Two rear pairs can be swivelled to provide club seating arrangement. Alternatively, centre row of seats can be quickly removed for carriage of cargo. Large (two-part, horizontally split) door on port side. Removable 1.88 m (6 ft 2 in) x 0.91 m (3 ft 0 in) panel on starboard side for loading. Baggage shelf.

AVIONICS: To customer's specification.

DIMENSIONS, EXTERNAL:

Wing span without winglets	10.67 m (35 ft 0 in)
Wing chord: at root	1.52 m (5 ft 0 in)
at tip	0.91 m (3 ft 0 in)
Wing aspect ratio	8.8
Length overall	7.62 m (25 ft 0 in)
Max width of fuselage	1.27 m (4 ft 2 in)
Height overall	2.90 m (9 ft 6 in)
Tailplane span	4.17 m (13 ft 8 in)
Tailplane chord: at root	0.91 m (3 ft 0 in)
at tip	0.56 m (1 ft 10 in)
Wheelbase	2.34 m (7 ft 8 in)
Wheel track	2.08 m (6 ft 10 in)

DIMENSIONS, INTERNAL:

Cabin: Length	3.30 m (10 ft 10 in)
Max width	1.24 m (4 ft 1 in)

AREAS:

Wings, gross	13.00 m ² (140.0 sq ft)
Vertical tail surfaces (total)	1.78 m ² (19.20 sq ft)
Tailplane	3.07 m ² (33.00 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	998 kg (2,200 lb)
Max payload	499 kg (1,100 lb)
Max T-O weight	1,724 kg (3,800 lb)
Max wing loading	132.5 kg/m ² (27.14 lb/sq ft)
Max power loading: 300 hp	7.71 kg/kW (12.67 lb/hp)
350 hp	6.61 kg/kW (10.86 lb/hp)

PERFORMANCE:

Max operating speed (VMO):	
300 hp	220 kt (407 km/h; 253 mph)
350 hp	266 kt (493 km/h; 306 mph)
Max cruising speed at 2,500 rpm:	
300 hp	200 kt (370 km/h; 230 mph)
350 hp	256 kt (474 km/h; 295 mph)
Stalling speed, power off, flaps down	62 kt (115 km/h; 71 mph)
Max rate of climb at S/L: 300 hp	488 m (1,600 ft)/min
350 hp	792 m (2,600 ft)/min
Service ceiling	9,750 m (32,000 ft)
T-O run	549 m (1,800 ft)
Landing run	213 m (700 ft)
Landing from 15 m (50 ft)	366 m (1,200 ft)
Range at cruising speed, no reserves	2,346 n miles (4,345 km; 2,700 miles)



Prototype ADI Super Stallion, following retrofit with winglets (Paul Jackson)

0110737

ADVANCED AERO

ADVANCED AERO COMPANY

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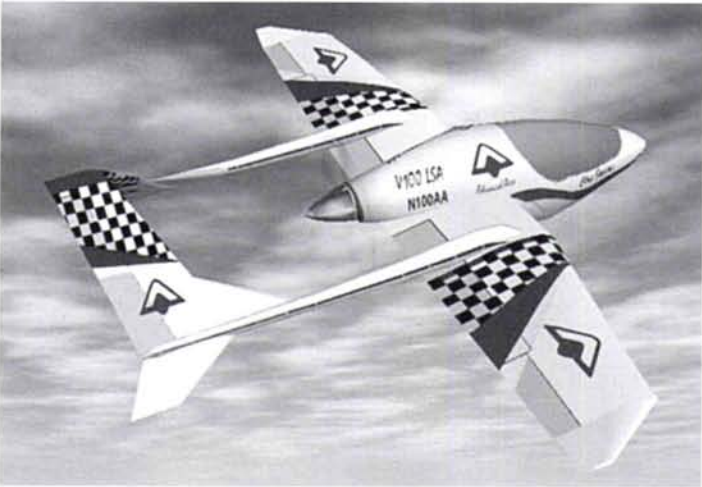
In 2004, Advanced Aero announced its search for financial backing to launch the first of a family of 'inverted V tail' aircraft which could include light transports, jets and UAVs. A technology demonstrator has flown. The company's plant covers 930 m² (10,000 sq ft).

ADVANCED AERO LSA-IVT

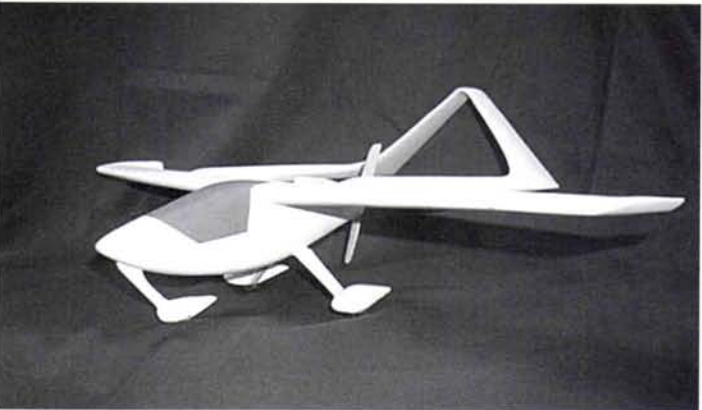
TYPE: Two-seat lightplane.

PROGRAMME: Announced 2004, following trials of one-fifth scale model. Financial backers being sought. Technology demonstrator, Advanced Aero Vortex, converted from Sadler Vampire c/n 26, made first flight (N101VX) 30 December 2005.

CURRENT VERSIONS: **LSA-IVT Sport Cruiser:** As described.



Advanced Aero LSA-IVT Sport Cruiser artist's impression 1159011



Impression of Advanced Aero LSA-IVT Sport Trainer 1159012

LSA-IVT Sport Aero: Available as baseline Aero with 59.6 kW (79.9 hp) Rotax 912; Aero SP with 73.5 kW (98.6 hp) Rotax 912S; or GA Trainer with Textron Lycoming O-235 of 85.7 kW (115 hp).

COSTS: Unit cost USD50,000 to USD60,000 (2007).

DESIGN FEATURES: Inverted V tail (IVT) designs to US Light Sport Aircraft certification category. Twin-boom, pusher propeller configuration with V-type tail surfaces joined on centreline. Advantages of IVT include increased safety (no propwash-induced yaw on take-off; less empennage blanking at high AoA on landing approach; reduced danger of human/vehicle propeller strike when on ground); stronger airframe (rigidity of empennage); improved performance (increased aspect ratio, thus reduced drag, of empennage); quietness (engine and propeller behind crew; reduced vibration) and reduced production costs (fewer parts). Single configuration allows for multiple power plant choices, including piston-tractor/pusher/tandem; turboprop pusher/tractor/twin; or turbofan single or twin.

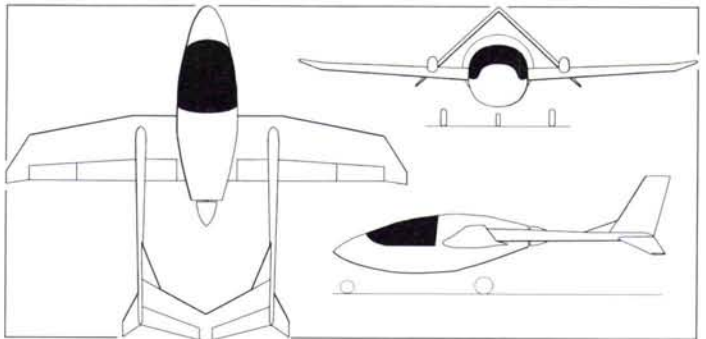
Wing section NACA 64A417 (Mod); dihedral 3°; washout 4°.

FLYING CONTROLS: Manual, Ailerons and ruddervators, Flaps. All control surfaces balanced and actuated by pushrods.

STRUCTURE: Composites, semi-monocoque fuselage of carbon fibre and glass epoxy, with local Kevlar reinforcements. Wing has I-beam main spar with caps of S-Glass protrusions



Advanced Aero Vortex technology demonstrator (R W Simpson) 1159013



General arrangement of baseline Advanced Aero IVT (Paul Jackson) 1047708

and metal, flush riveted, aluminium skin. Tailbooms and empennage of aluminium with glass epoxy streamline fairings. All metal parts epoxy-primed with final exterior polyurethane top coat.

LANDING GEAR: Tricycle type; fixed. Dual disc brakes; nosewheel steering suitable for grass operations.

POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912S flat-four piston engine driving a three-blade, fixed pitch propeller. Fuel in two wing tanks, combined capacity 76 litres (20.0 US gallons; 16.7 Imp gallons).

ACCOMMODATION: Two persons, side by side.

EQUIPMENT: Ballistic parachute.

Data follow for baseline IVT two-seat version.

DIMENSIONS, EXTERNAL:

Wing span	8.32 m (27 ft 3½ in)
Length: fuselage	4.64 m (15 ft 2½ in)
to end of tailbooms	6.71 m (22 ft 0 in)
Max diameter of fuselage	1.24 m (4 ft 1 in)
Height overall	2.50 m (8 ft 2½ in)
Tailplane span (incl underfins)	3.44 m (11 ft 3½ in)
Wheel track	2.26 m (7 ft 5 in)
Wheelbase	2.83 m (9 ft 3½ in)
Propeller ground clearance on tail-scraper	0.25 m (10 in)
Distance between tailboom centres	2.74 m (9 ft 0 in)

AREAS:

Wings, gross	10.5 m² (113.0 sq ft)
Tailplane	2.80 m² (30.20 sq ft)

WEIGHTS AND LOADINGS:

Max T-O weight	598 kg (1,320 lb)
Max baggage weight	23 kg (50 lb)
Payload with max fuel	204 kg (450 lb)

PERFORMANCE:

Max level speed	120 kt (222 km/h; 138 mph)
Stalling speed, flaps down	38 kt (71 km/h; 44 mph)
Max rate of climb at S/L	396 m (1,300 ft)/min
Range at 75% power	470 n miles (870 km; 540 miles)

AERION

AERION CORPORATION
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CHIEF OPERATING OFFICER: Michael L Henderson
CHIEF ENGINEER James D Chase
DIRECTOR: Robert L Morse, Jr
PRINCIPAL SCIENTIST: Ilan M Kroo

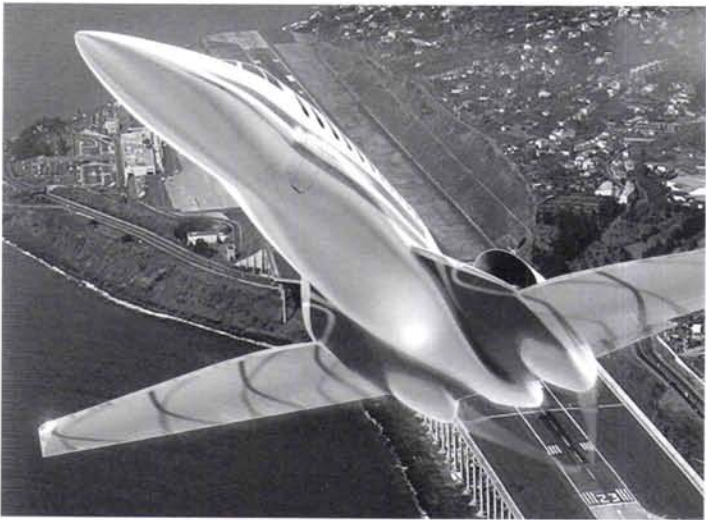
Aerion Corporation was established in 2002 to pursue development of supersonic aircraft incorporating natural laminar flow (NLF) technology. During 2006, Aerion was in discussions with several major aerospace firms and government agencies on three continents and anticipated finalising its choice of project partners during 2007.

AERION SBJ

TYPE: Supersonic business jet.

PROGRAMME: Initial studies (Design Cycle 1) between December 2003 and September 2004; announced at NBAA Convention in Las Vegas on 11 October 2004; detailed Design Cycle 2 begun September 2004 and included wind-tunnel tests and marketing survey; Design Cycle 2 – final element of Phase 1 – completed by September 2005, eliminating T-tail of earlier studies, among other improvements; expected five-year programme from launch (2007 or 2008) to certification.

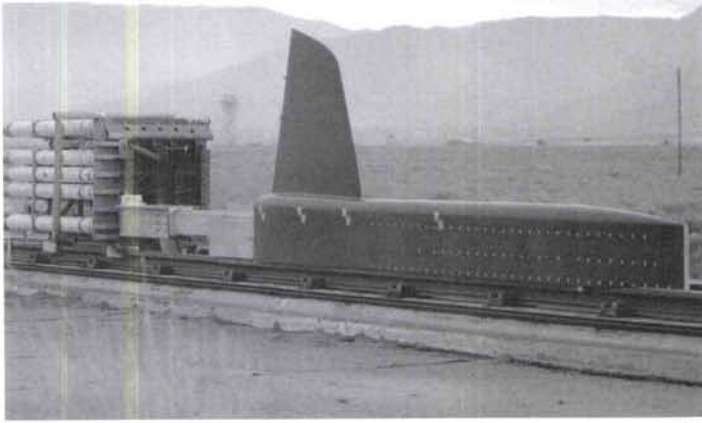
CUSTOMERS: Estimated market for 250 to 300 aircraft over 10-year period, 30 to 50 per cent of orders expected to come from fractional ownership operators.



Artist's impression of Aerion SBJ departing Madeira/Funchal 1159697

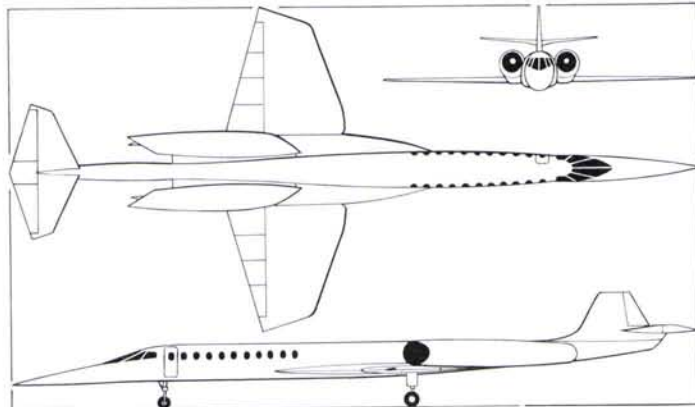
COSTS: Target price USD80 million. Estimated direct operating cost USD8 per mile (both 2004).

DESIGN FEATURES: Low-risk design using mostly established technology and not dependent for market viability upon repeal of legislation prohibiting supersonic flight over land. Low



Rocket sled employed to test Aerion SBJ scale wing at Mach 1.55

1159698



Aerion SBJ general arrangement (James Goulding)

1151431

cruising speed of Mach 0.99, where required; 'boomless' cruise at Mach 1.1; max (unlimited) cruising speed Mach 1.6.

Fuselage has vertical oval cross-section in forward cabin, transitioning to oval in main cabin. Trapezoidal wing planform of natural laminar flow (NLF) section with rated wingtips; thickness 3% at root, 2% at tip. At supersonic cruise, achieves laminar flow over as much as 70 per cent of upper surface and up to whole lower surface. Cruciform tail with swept fin; area-ruled fuselage; engines pod-mounted on rear fuselage. Large trailing-edge flaps serve as flaperons for roll control (obviating spoilers) and are fitted with unique feature

of secondary split flap at approximately half-chord to enhance low-speed capability and permit nose-down flight deck angle on landing approach; no leading-edge high-lift devices. Small notch in wing leading-edge at intersection with fuselage.

FLYING CONTROLS: Powered, electronically-signalled, hydraulically-actuated control surfaces. Flaps. Speedbrake.

STRUCTURE: Carbon fibre wings; high-strength aluminium alloy fuselage.

LANDING GEAR: Tricycle type; retractable. Two wheels in tandem on main units, twin wheels on nose unit. Ground turning radius less than 22.8 m (75 ft).

POWER PLANT: Two Pratt & Whitney JT8D-219 turbofans, each flat rated at 87.2 kN (19,600 lb st), with modified fan, upgraded compressor section and new exhaust mixer nozzle; low take-off thrust rating will enable the aircraft to meet Stage IV noise requirements. Thrust reverser. Fixed geometry scarfed air intakes. Fuel contained in wing and fuselage tanks.

ACCOMMODATION: Flat floor cabin with typical accommodation for 10 passengers, with two individual seats forward and two sets of club four seats aft; maximum 12 passengers; 11 cabin windows per side; galley at front and lavatory and baggage compartment at rear of cabin. Door forward, to rear of flight deck.

SYSTEMS: Stability augmentation system; pilot's commands are signalled to control surfaces electronically, but absence of AFCS and positive stability mean aircraft is not FBW in full sense. Tailplane size permits full control by pilot in the event of stability augmentation system failure. Cabin pressurisation system will have maximum pressure differential of 0.55 to 0.69 bar (8 to 10 lb/sq in).

DIMENSIONS, EXTERNAL:

Wing span	19.56 m (64 ft 2 in)
Wing aspect ratio	3.3
Length overall	41.30 m (135 ft 6 in)
Height overall	6.45 m (21 ft 2 in)

DIMENSIONS, INTERNAL:

Cabin (cockpit divider to aft pressure bulkhead):

Length	9.14 m (30 ft 0 in)
Max width	1.98 m (6 ft 6 in)
Max height	1.83 m (6 ft 0 in)
Volume	27.75 m ³ (980.0 cu ft)

AREAS:

Wings, gross	111.48 m ² (1,200 sq ft)
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WEIGHTS AND LOADINGS:

Basic operating weight	20,457 kg (45,100 lb)
Max fuel weight	20,593 kg (45,400 lb)
Max T-O weight	40,823 kg (90,000 lb)
Max wing loading	366.2 kg/m ² (75.00 lb/sq ft)
Max power loading	255 kg/kN (2.50 lb/lb st)

PERFORMANCE (at max T-O weight, ISA, except where indicated):

Max cruising speed	M1.60
Long-range cruising speed	M1.50
No-boom cruising speed	more than M1.10
High subsonic cruising speed	M0.99
Long-range subsonic cruising speed	M0.95
Approach speed	120 kt (222 km/h; 138 mph)
Max operating altitude	15,545 m (51,000 ft)
T-O balanced field length	less than 1,829 m (6,000 ft)
Landing run, wet runway	less than 1,524 m (5,000 ft)
Range with NBAA IFR reserves, subsonic or supersonic	more than 4,000 n miles (7,408 km; 4,603 miles)

AEROCOMP

AEROCOMP

Aerocomp has changed name to Comp Air Inc.

AEROLITES

AEROLITES INC

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PRESIDENT: Daniel J Roché

AEROLITES AEROMASTER AG

TYPE: Agricultural sprayer ultralight.

PROGRAMME: Prototype (N17AG) first flown 1993.

CUSTOMERS: Total of 34 flying by mid-2005, including at least one in South Africa.

COSTS: Kit USD24,995 (2005).

DESIGN FEATURES: Strut-braced aluminium wing has ladder construction with internal diagonal bracing tested to +6/-4 g; aluminium ribs slot into pockets within fabric covering. Quoted build time 130 hours. Quoted spray coverage 61-81 ha (150-200 acres) per hour.

FLYING CONTROLS: Conventional and manual.



Aerolites Aeromaster agricultural ultralight

1158638

STRUCTURE: Fuselage of welded 4130 chromoly with fabric covering; aluminium wing ribs.

LANDING GEAR: Tailwheel type; fixed.

POWER PLANT: One 47.8 kW (64.1 hp) Rotax 582 two-cylinder engine driving Warp Drive carbon fibre three-blade propeller through C type 3:1 reduction gear. Fuel capacity 38 litres (10.0 US gallons; 8.3 Imp gallons).

EQUIPMENT: 12-nozzle SprayMiser CDA system fitted for agricultural operations; belly tank capacity 114 litres (30.0 US gallons; 25.0 Imp gallons). Optional ballistic parachute and electric starter.

DIMENSIONS, EXTERNAL:

Wing span	8.74 m (28 ft 8 in)
Length overall	5.64 m (18 ft 6 in)
Height overall	2.11 m (6 ft 11 in)

AREAS:

Wings, gross	13.54 m ² (145.7 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	193 kg (425 lb)
Max T-O weight	453 kg (1,000 lb)

PERFORMANCE (with SprayMiser system fitted):

Never-exceed speed (VNE)	95 kt (177 km/h; 110 mph)
Normal cruising speed	65 kt (121 km/h; 75 mph)
Spray speed	56 kt (105 km/h; 65 mph)
Stalling speed	28 kt (52 km/h; 32 mph)
Max rate of climb at S/L	244 m (800 ft)/min
T-O run	153 m (500 ft)
Landing run	61 m (200 ft)
Range with max fuel	160 n miles (296 km; 184 miles)
Swath width	9-30 m (30-100 ft)
g limits	+6/-4

AEROLITES AEROSKIFF

TYPE: Two-seat amphibian ultralight kitbuild.

CUSTOMERS: Nine flying by end-2005.

COSTS: Kit USD24,795 (2005).

DESIGN FEATURES: Pusher layout. Wings detach for storage. Quoted build time 190 hours.

FLYING CONTROLS: Conventional and manual. High-lift flaps.

STRUCTURE: Glass fibre fuselage and fabric-covered, strut-braced wings.



Aerolites Aeroskiff 0561756

LANDING GEAR: Tailwheel type; tailwheel also retracts for water landings. Drum brakes. Floats mounted on tubular outriggers at wing mid-point.

POWER PLANT: One 47.8 kW (64.1 hp) Rotax 582 water-cooled engine is standard; optionally, 55.0 kW (73.8 hp) Rotax 618. Fuel capacity 45 litres (12.0 US gallons; 10.0 Imp gallons).

SYSTEMS: Optional bilge pump and electric starter.

DIMENSIONS, EXTERNAL:

Wing span	9.04 m (29 ft 8 in)
Length overall	6.81 m (22 ft 4 in)
Height overall	2.13 m (7 ft 0 in)

DIMENSIONS, INTERNAL:

Cabin max width	1.12 m (3 ft 8 in)
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AREAS:

Wings, gross	14.49 m ² (156.0 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	256 kg (565 lb)
Max T-O weight	510 kg (1,125 lb)

PERFORMANCE (Rotax 582):

Never-exceed speed (VNE)	82 kt (152 km/h; 95 mph)
Normal cruising speed	56 kt (105 km/h; 65 mph)
Stalling speed	33 kt (62 km/h; 38 mph)
Max rate of climb at S/L	183 m (600 ft)/min
Service ceiling	3,050 m (10,000 ft)
T-O run: water	168 m (550 ft)
land	122 m (400 ft)
Landing run: land	92 m (300 ft)
Range	140 n miles (259 km; 161 miles)

AEROLITES BEARCAT

TYPE: Single-seat ultralight kitbuilt.

CUSTOMERS: Total of 38 completed by early 2006.

AEROS

WORLDWIDE AEROS CORPORATION

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Web: www.aerosml.com

CEO: Igor Pasternak

EXECUTIVE VICE-PRESIDENT, BUSINESS DEVELOPMENT: Frederick Edworthy

Aeros was founded in 1987, and has since established itself as a leader in innovative lighter than air (LTA) technologies and manufacturing. Its product line includes a full spectrum of LTA vehicles, including the current Aeros 40D Sky Dragon FAA-certified airship, the partially buoyant Aeroscraft, and a range of tethered aerostat systems. Research and development has enabled Aeros successfully to develop innovative solutions for government and commercial programmes, including high-altitude and heavy-lift airships, and sensor platforms; its revenues are divided equally between government and civilian customers. Company headquarters, engineering and manufacturing are located in Los Angeles, California, with a work force of 50 comprising an engineering group and a technical production group, plus management and administrative personnel.

Aeros' newest airship, the 40D Sky Dragon, incorporates the latest technologies. Future focus is on production of the Aeroscraft, which encompasses capabilities (VTOL, low energy consumption and unprecedented cargo volumes, making it particularly well suited for low-density and perishable cargos as well as other missions) that entitle it to be classed as a new type of aircraft. During 2005-06, it has been advanced by demonstration of key technologies, and manufacture of the first ML 16 production series was beginning in the fourth quarter of 2006.

AEROS 40D SKY DRAGON

TYPE: Helium non-rigid airship.

PROGRAMME: Prototype: first flight (N818AC, c/n 16) 11 September 1998; exported to China (Thakral Media Corporation) in November 1998; operating in Hong Kong 1999. Three more (one for Argos Medien AG of Germany and two more for China) under construction in 1999-2001, of which c/n 17 (N819AC for China) destroyed in accident on 9 January 2001; c/n 18 (N820AC for Argos Medien) registered in January 2001, delivered in February 2002 but reverted to US registry in August 2003 and crashed in Portugal 12 June 2004.

FAA certification 21 June 2000; STC for external payload mounting awarded January 2001. Certified by LBA (Germany) January 2002; validation of type certificate by CAAC (China), July 2006.

Latest version (2006) is Aeros 40D: larger in size, volume and able to carry larger payloads than earlier versions; also incorporates new rapid deflation system, IFR capability, and camera system for envelope monitoring. Design driven by need to carry out surveillance missions requiring integration of IR cameras, radars and datalink systems.

CUSTOMERS: Six examples identified, N818AC (c/n 19) registered 20 March 2002; completed 2004 as surveillance platform (E-O/IR and other sensors) and delivered to Trinidad and Tobago Special Anti-Crime Unit following airworthiness certification 31 March; formally



Aerolites Bearcat promoted for LSA category 1158643

COSTS: Kit USD14,695, including engine and propeller (2004).

DESIGN FEATURES: Replica Corben Baby Ace (1930s vintage). Parasol wing is strut-braced and similar to AeroMaster, but struts are joined to fuselage at separate points rather than meeting at single point. Quoted build time 125 hours.

FLYING CONTROLS: Conventional and manual.

STRUCTURE: Fabric-covered 4130 chromoly fuselage and aluminium extruded-wing spar.

LANDING GEAR: Tailwheel type; fixed. Bungee shock absorption on main legs; optional hydraulic disc brakes.

POWER PLANT: One 31.0 kW (41.6 hp) Rotax 447 in-line two-cylinder piston engine, driving a two-blade propeller. Optionally, 37.0 kW (49.6 hp) Rotax 503 UL-2V. Fuel capacity 19 litres (5.0 US gallons; 4.2 Imp gallons).

DIMENSIONS, EXTERNAL:

Wing span	9.14 m (30 ft 0 in)
Length overall	5.33 m (17 ft 6 in)
Height overall	1.96 m (6 ft 5 in)

AREAS:

Wings, gross	13.94 m ² (150.0 sq ft)
--------------	------------------------------------

WEIGHTS AND LOADINGS:

Weight empty	125 kg (275 lb)
Max T-O weight	317 kg (700 lb)

PERFORMANCE:

Never-exceed speed (VNE)	95 kt (177 km/h; 110 mph)
Max operating speed	65 kt (121 km/h; 75 mph)
Normal cruising speed	59 kt (109 km/h; 68 mph)
Stalling speed	24 kt (44 km/h; 27 mph)
Max rate of climb at S/L	228 m (750 ft)/min
T-O and landing run	46 m (150 ft)
Range with max fuel	125 n miles (231 km; 143 miles)
g limits	+6/-4



Aeros 40B flight deck 1196909

handed over on 20 October 2005, although first trial mission was flown on 16 July 2005. Systems testing for c/n 20 began 18 April 2005 and first metal cut for c/n 21 on 2 May 2005. First 40D due for delivery by end of 2006.

COSTS: Trinidad and Tobago USD32 million, plus USD8 million for surveillance equipment (2005).

Following details apply to Aeros 40D.

DESIGN FEATURES: X configuration tail unit, each with ruddervator. One ellipsoid ballonnet forward and one aft (together, 26 per cent of total volume). Internal illumination by three 400 W lamps: one above gondola and one in each ballonnet.

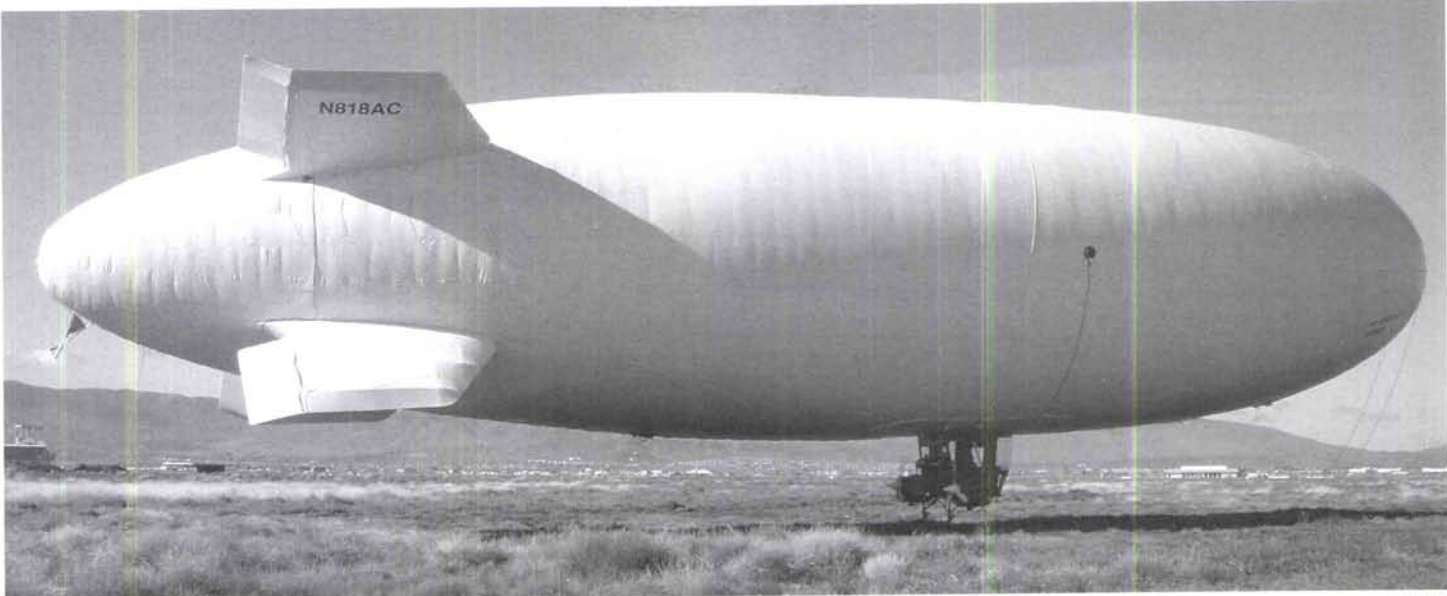
FLYING CONTROLS: Fly-by-wire electronically controlled, pneumatically actuated ruddervators, with manual back-up.

STRUCTURE: Envelope made up of 1,020 heat-sealed panels of a transparent, nylon-based, 7 ply polyurethane coated fabric; tailfins aluminium alloy with fabric covering. Aluminium alloy semi-monocoque gondola, with polycarbonate sheet transparencies.

LANDING GEAR: Two mainwheels, with shock-absorbers.

POWER PLANT: Two 93 kW (125 hp) Teledyne Continental IO-240 flat-four engines; MTV-7-D/LD170-12 variable- and reversible-pitch, three-blade wood/composites pusher propellers. Fuel capacity 287 litres (75.9 US gallons; 63.2 Imp gallons), of which 267 litres (70.5 US gallons; 58.7 Imp gallons) are usable.

ACCOMMODATION: Pilot and four passengers. Front two seats fully articulating and reclining; three bucket seats to rear. Full-depth windscreen; two doors, with upper and lower windows, in each side of gondola.



Aeros 40B Sky Dragon preparing for take-off

1196908

SYSTEMS: Pressure maintained by two air valves in each ballonnet, each pneumatically actuated by an electric blower and having mechanical return springs. Two ballast compartments in gondola. Electrical system 28 V DC and 115 V AC. Nosecone mast mooring; ground handling crew of eight.

AVIONICS: Digital 'glass cockpit' package includes audio panel, voice annunciator, colour LEDs, GPS/com 2, nav/com 1 and transponder/encoder; readings displayed in both digital and analogue form.

DIMENSIONS, EXTERNAL:

Length overall	46.60 m (152 ft 10¾ in)
Envelope: Length	45.60 m (149 ft 7½ in)
Max diameter	10.60 m (34 ft 9½ in)
Fineness ratio	4.3
Height overall	13.35 m (43 ft 9½ in)
Banner (each side): Length	22.86 m (75 ft 0 in)
Height	7.92 m (26 ft 0 in)
Propeller diameter	1.70 m (5 ft 7 in)

DIMENSIONS, INTERNAL:

Envelope volume	2,773 m³ (97,925 cu ft)
Ballonet volume (two, total)	549.2 m³ (19,396 cu ft)
Gondola cabin: Length	1.96 m (6 ft 5 in)
Max width	1.57 m (5 ft 2 in)
Max height	1.73 m (5 ft 8 in)

AREAS:

Banner area (each side)	185.34 m² (1,995.0 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	1,891 kg (4,170 lb)
Useful load	978 kg (2,157 lb)

PERFORMANCE:

Max level speed	44 kt (82 km/h; 51 mph) IAS
Max rate of climb	610 m (2,000 ft)/min
Max rate of descent	610 m (2,000 ft)/min
Max certified altitude	2,135 m (7,000 ft)
Endurance: at 45% power	6 h 42 min
max	24 h

AEROS AEROSCRAFT

TYPE: Hybrid buoyant aircraft.

PROGRAMME: Development under way in 2006. Planned in four size configurations (see data below) to suit specific market segments. First of initial series (ML 16) targeted for roll-out in late 2008.

CUSTOMERS: Primary market interest foreseen as coming from resource-based exploration companies and luxury tour operators.

DESIGN FEATURES: New air vehicle concept combining positive effect of static lift provided by helium-filled internal gas cells with dynamic lift created by body shape. Positive buoyancy control system allows craft to achieve operating parameters said to make it well suited to many non-conventional types of mission. VTOL capability allows craft to circumvent traditional intermodal freight systems and operate autonomously without the aid of ground-based infrastructure.

FLYING CONTROLS: Aeros proprietary buoyancy control system.

STRUCTURE: Completely rigid body with rear-mounted propulsion units.

Following data all provisional:

DIMENSIONS, EXTERNAL:

Length overall: ML 16	64.8 m (212.6 ft)
ML 60	123 m (403.5 ft)
ML 250	180 m (590.6 ft)
ML 500	238 m (780.8 ft)
Max width: ML 16	28.2 m (92.5 ft)
ML 60	42 m (137.8 ft)
ML 250	47 m (154.2 ft)
ML 500	66 m (216.5 ft)

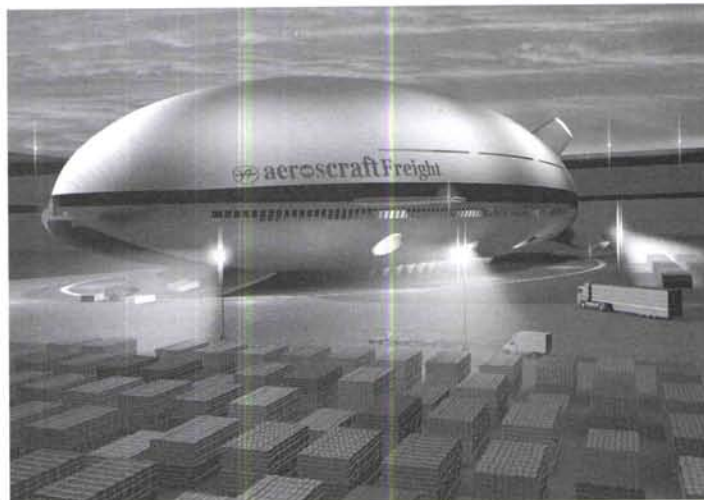
DIMENSIONS, INTERNAL:

Total volume: ML 16	16,800 m³ (593,300 cu ft)
ML 60	100,000 m³ (3.53 million cu ft)
ML 250	450,000 m³ (15.9 million cu ft)
ML 500	855,000 m³ (30.2 million cu ft)



Typical Aeroscraft in passenger configuration

1196912



Aeroscraft in cargo configuration

1196911

WEIGHTS AND LOADINGS:

Payload: ML 16	6,000 kg (13,230 lb)
ML 60	60,000 kg (132,275 lb)
ML 250	250,000 kg (551,150 lb)
ML 500	500,000 kg (1,102,300 lb)

PERFORMANCE (estimated):

Max level speed: ML 16	110 kt (203 km/h; 126 mph)
ML 60, ML 250	120 kt (222 km/h; 138 mph)
ML 500	150 kt (277 km/h; 172 mph)
Operating altitude: ML 16	3,000 m (9,840 ft)
ML 60	3,200 m (10,500 ft)
ML 250, ML 500	3,500 m (11,480 ft)

AG CAT

ALLIED AG CAT PRODUCTION INC
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e-mail: agcat@bscn.com
PRESIDENT: Frank D Kelley

Grumman G-164 Ag Cat radial-engined agricultural biplane first flew 22 May 1957 and certified 20 January 1959; produced under subcontract by Schweizer; rights passed to Gulfstream American upon its separation from Grumman, but planned transfer of manufacture

to Savannah, Georgia, forestalled by Schweizer's outright purchase of programme in January 1981. Total of over 2,600 built, latterly only to specific order, before programme sold to Ag Cat Corporation of Malden, Missouri, in January 1996. Type Certificate again transferred on 22 February 2001 to current owner.

Allied Ag Cat supports the worldwide fleet of some 2,000 G-164 variants, some being G-164D, certified 26 March 1979 with Pratt & Whitney PT6A turboshaft, or similarly-powered Super B (certified 23 December 1985); services include remanufacture of existing airframes. Allied Ag Cat previously had plans to reintroduce new production aircraft from 2007 (12 in first year; 24 thereafter), principally Ag Cat Super-B Turbine with 507 kW (680 shp) or 559 kW (750 shp) PT6A-15AG/-34AG engines and 1,514 litre (400 US gallons; 333 Imp gallon) chemical hopper. Manufacture intended at Walnut Ridge Airport. However, in 2006, these plans were suspended indefinitely.

AIR

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CHAIRMAN: Rick Schrameck
PRESIDENT, R&D AND MANUFACTURING: Bob Fair
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Formed to produce the Epic LT for the Experimental category, AIR moved into 8,360 m² (90,000 sq ft) accommodation at Bend, Oregon, on 1 June 2005. The company is also developing a jet version of the basic design (although with new wing) and will manufacture a certified Epic as the Dynasty at a new, 9,290 m² (100,000 sq ft) factory at Spring Bank Airport, Calgary, Canada, plans for which were announced on 5 September 2006. Employment at Bend was 127 in mid-2006.

AIR EPIC LT and DYNASTY

TYPE: Business turboprop.
PROGRAMME: Epic LT announced at AirVenture, Oshkosh, July 2003; first flight (N370JP) 17 July 2004. Initially available as Experimental category kitbuilt with Walter or PT6A engine with first components delivery of this version in first quarter of 2005. First customer completion was N89CL by Carlton Cadwell. First Dynasty (C-FJRQ) completed from 14th LT airframe; initial public display at NBAA Convention, Orlando, Florida, 17 October 2006, Canadian certification expected in 2008.
CURRENT VERSIONS: **Epic LT:** As described. Experimental category version; kitbuilt. Available as **Model 800** with Walter engine or **Model 1200** with P&W.
Dynasty: Certified version; available from early 2008.
Epic Jet: Twin-turboprop version produced in collaboration with TAM of Georgia. Described separately.
CUSTOMERS: More than 50 orders for LT by July 2005. Eight LTs flying by 19 December 2006, on which day N468TT (c/n 012) made initial sortie.
COSTS: Experimental category kit USD895,000 with Walter engine; USD1.16 million with PT6A. Certified Dynasty USD1.95 million (PT6A) (2006).
DESIGN FEATURES: "Full people; full fuel; full speed" capability intended. Designed for owner/operator requiring luxury motorcar standard of comfort; interior styled by Nissan Design Centre. Optional winglets.
FLYING CONTROLS: Conventional and manual. Flaps.
STRUCTURE: Generally of carbon fibre.
POWER PLANT: One turboprop: 560 kW (751 shp) Walter M 601 or 895 kW (1,200 shp) Pratt & Whitney Canada PT6A-67 according to version. Standard fuel capacity 1,136 litres (300 US gallons; 250 Imp gallons) gross, of which 1,091 litres (288 US gallons; 240 Imp gallons) usable; optional long-range tanks of unspecified volume.



AIR Epic LT flight deck 1040573

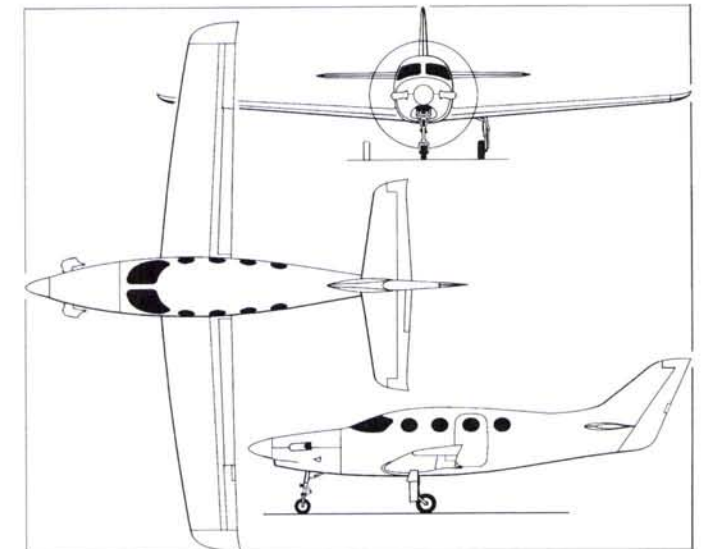
ACCOMMODATION: Six persons, including pilot(s); rear occupants in 'club four' configuration. Cabin pressurised. Cabin pressure differential 0.45 bar (6.5 lb/sq in).
DIMENSIONS, EXTERNAL:
Wing span 13.11 m (41 ft 2½ in)
Length overall 11.20 m (36 ft 9 in)
Height overall 3.81 m (12 ft 6 in)
AREAS:
Wings, gross 18.92 m² (203.6 sq ft)
DIMENSIONS, INTERNAL:
Cabin: Length 4.57 m (15 ft 0 in)
Max width 1.40 m (4 ft 7 in)
Max height 1.50 m (4 ft 11 in)
WEIGHTS AND LOADINGS:
Weight empty: LT 1,905 kg (4,200 lb)
Dynasty 1,814 kg (4,000 lb)
Payload: LT with max fuel 544 kg (1,200 lb)
Dynasty with standard fuel 603 kg (1,300 lb)



AIR Epic Dynasty development aircraft accompanied by kitbuilt Epic LT 1040572



Typical cabin of AIR Epic LT 1040574



AIR Epic LT business turboprop (Paul Jackson) 1158930

Max T-O weight: LT	3,324 kg (7,329 lb)
Dynasty	3,311 kg (7,300 lb)
Max wing loading: LT	175.8 kg/m ² (36.00 lb/sq ft)
Dynasty	175.1 kg/m ² (35.85 lb/sq ft)
Max power loading: LT (PT6A)	3.72 kg/kW (6.11 lb/shp)
Dynasty	3.70 kg/kW (6.08 lb/shp)
PERFORMANCE (estimated, PT6A engine):	
Cruising speed: max	350 kt (648 km/h; 403 mph) IAS
econ	289 kt (535 km/h; 333 mph) IAS
Time to FL280	11 min
Max certified altitude: LT	8,535 m (28,000 ft)
Dynasty	9,450 m (31,000 ft)

AIR COMMAND

AIR COMMAND INTERNATIONAL INC

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 PRESIDENT: Harold Smith

Formed in 1985 and reorganised May 1992, Air Command produces kits of autogyros; with options, there are seven sub-versions of the Elite currently available; five of which are single-seat versions.

In 2003, Air Command had a 465 m² (5,000 sq ft) factory and seven employees.

AIR COMMAND COMMANDER ELITE

TYPE: Single-seat autogyro ultralight kitbuilt; two-seat autogyro ultralight kitbuilt.
 PROGRAMME: Construction of tandem-seat F-30 began in late 1999; made first flight 1 March 2000; public debut at Sun 'n' Fun, April 2000. A side-by-side version of the F-30 has been introduced. Second-generation machines denoted by 'Elite' suffix.
 CURRENT VERSIONS: **Commander 447:** Single-seat version, powered by 29.5 kW (39.6 hp) Rotax 447.

Commander 503: As Commander 447, but with 37.0 kW (49.6 hp) Rotax 503.
Commander Elite 3202: As Commander 447, but with 41.0 kW (55 hp) Hirth 3202.
Commander 582: As Commander 447, but with 47.8 kW (64.1 hp) Rotax 582.

T-O to 15 m (50 ft), LT	488 m (1,600 ft)
Landing from 15 m (50 ft), LT	561 m (1,840 ft)
Range, 45 min reserves:	
LT at max cruising speed	1,369 n miles (2,535 km; 1,575 miles)
LT at econ cruising speed	1,608 n miles (2,978 km; 1,850 miles)
Dynasty at econ cruising speed and with long-range tanks	1,874 n miles (3,472 km; 2,157 miles)

AIR EPIC ELITE

TYPE: Private jet.
 PROGRAMME: Announced (as Epic Jet) at the NBAA Convention in Las Vegas 20 October 2004; development is jointly with TAM-AIR of Tbilisi, Georgia; fuselage mockup unveiled at EAA AirVenture, Oshkosh, 27 July 2005; first flight of prototype scheduled for October 2005 but delayed, in part by legal dispute with Farnborough Aircraft over rights to wing design. AIR elected to transfer development and production of aircraft to Canada, where prototype (C-GROL) registered in July 2006, coincident with announcement of name, Elite. Although structurally complete, C-GROL was unable to fly for legal reasons and did not make planned debut at Oshkosh in July 2006; in satisfaction of court ruling, new wing design was purchased from Germany and fitted to aircraft in latter part of 2006. Certification due in late 2008. Two production lines planned; AIR supplying aircraft to North American market; TAM to rest of world.

CUSTOMERS: By July 2005, six Epic LT customers had also purchased Epic Jets.
 COSTS: USD2.35 million, certified (2006).

DESIGN FEATURES: Based on Epic LT turboprop with two podded, rear-mounted turbofan engines and T tail. Revised (2006) wing design has two-step sweep on outer panels.

STRUCTURE: Mostly carbon fibre composites with high fuselage and systems commonality with Epic LT.

LANDING GEAR: Tricycle type; retractable.

POWER PLANT: Two rear-mounted Williams FJ33-4 turbofan engines, rated at 8.45 to 8.00 kN (1,900 lb st). Max fuel capacity 1,211 litres (320 US gallons; 266.5 Imp gallons).

ACCOMMODATION: Six to eight seats in pressurised cabin. Payload with full fuel and 54 kg (120 lb) baggage is seven seats.

SYSTEMS: Pressurisation system, maximum differential 0.6 bar (8.5 lb/sq in).

AVIONICS: Garmin 1000 as core system.

DIMENSIONS, EXTERNAL:

Wing span	13.41 m (44 ft 0 in)
Length overall	11.91 m (39 ft 11 in)
Height overall	3.78 m (12 ft 5 in)

DIMENSIONS, INTERNAL:

Cabin: Length	5.18 m (17 ft 0 in)
Max width	1.48 m (4 ft 9 in)
Max height	1.52 m (5 ft 0 in)

WEIGHTS AND LOADINGS:

Weight empty	1,814 kg (4,000 lb)
Payload with standard fuel	603 kg (1,330 lb)
Max T-O weight	3,492 kg (7,700 lb)
Max power loading	230 kg/kN (2.26 lb/lb st)

PERFORMANCE (estimated):

Max cruising speed	412 kt (763 km/h; 474 mph)
Econ cruising speed	385 kt (713 km/h; 443 mph)
Certified ceiling	12,495 m (41,000 ft)
Time to FL410	17 min
Range with six passengers at econ cruising speed	1,400 n miles (2,592 km; 1,611 miles)



Artist's impression of Epic Elite very light jet 1040570

Commander Elite 3203: As Commander 447, but with 48.5 kW (65 hp) Hirth 3203 and taller tail.

Elite F-30: Basic two-seat version, with Hirth F-30 engine.

Elite F-30ES: As F-30, but side-by-side seating.

Elite Subaru: As F-30, but with more powerful engine; under development during 2006.

CUSTOMERS: Over 1,000 kits sold in US by mid 2005.

COSTS: Commander 447 USD12,645, Commander 503 USD14,090, Commander 582 USD15,725, Commander Elite 3202 USD15,495, Commander Elite 3203 USD17,495; Elite F-30 USD22,475, Elite F-30ES USD21,792, all excluding engine (2006).

DESIGN FEATURES: Open cockpit autogyro with wide range of options to enable individual requirements to be met; many subassemblies preconstructed by factory. Quoted build time 100 hours.

STRUCTURE: Pre-drilled and anodised 6061-T6 tubular airframe; dual 2.5 x 5 cm (21 x 2 in) tubing used for mast. Optional glass fibre enclosure. F-30 has aluminium rudder and composites horizontal stabiliser and tailfins; Dragon Wings tip-weighted rotor blades.

LANDING GEAR: Fixed tricycle type with glass fibre wing fairings. Aluminium suspension system with Hager wheels and brakes on all wheels. Nosewheel is fully castoring with leg of 4130 steel tube and 6.00x6 Azusa tyres; 7.6 cm (3 in) tailwheel. Mainwheel hydraulic brakes.

POWER PLANT: One 82.0 kW (110 hp) Hirth F-30 driving a three- or four-blade graphite fibre Warp Drive propeller. Other options include the 29.5 kW (39.6 hp) Rotax 447, 37.0 kW (49.6 hp) Rotax 503 and 47.8 kW (64.1 hp) Rotax 582 for single-seat versions. Fuel capacity 37.9 litres (10.0 US gallons; 8.3 Imp gallons) in two seat tanks; optional 68.1 litre (18.0 US gallon; 15.0 Imp gallon) seat tank.

ACCOMMODATION: Pilot and passenger in tandem on Elite F-30; side by side on Elite F-30ES. SYSTEMS: Basic engine instrumentation is provided with each kit. Options include hydraulic



Air Command Tandem Elite F-30 1158644

pre-rotator and clutch reduction drive on F-30; and pre-rotator, C' Box upgrade and electric start on F-30ES. Optional New Horizons Components gyro recovery system rocket-powered ballistic parachute.

DIMENSIONS, EXTERNAL:

Rotor diameter: F-30	8.53 m (28 ft 0 in)
F-30ES	8.84 m (29 ft 0 in)
Rotor blade chord: F-30	0.19 m (7½ in)

Fuselage length: F-30	4.09 m (13 ft 5 in)
F-30ES	3.25 m (10 ft 8 in)
Height to top of rotor head: F-30	2.74 m (9 ft 0 in)
F-30ES	2.13 m (7 ft 0 in)
Width: F-30	1.88 m (6 ft 2 in)
F-30ES	1.70 m (5 ft 7 in)
Propeller diameter	1.73 m (5 ft 8 in)
AREAS:	
Rotor disc: F-30	57.2 m² (616.0 sq ft)
F-30ES	61.4 m² (661.0 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty: F-30	222 kg (490 lb)
F-30ES	141 kg (310 lb)
Max payload: both	191 kg (420 lb)
Max T-O weight: F-30	578 kg (1,275 lb)
F-30ES	412 kg (910 lb)
Max disc loading: F-30	10.1 kg/m² (2.07 lb/sq ft)
F-30ES	6.7 kg/m² (1.38 lb/sq ft)
Max power loading: F-30	7.05 kg/kW (11.59 lb/hp)
F-30ES	5.04 kg/kW (8.27 lb/hp)
PERFORMANCE:	
Max operating speed: F-30	95 kt (177 km/h; 110 mph)
F-30ES	73 kt (135 km/h; 84 mph)
Cruising speed:	
F-30	65–70 kt (121–129 km/h; 75–80 mph)
F-30ES	56 kt (105 km/h; 65 mph)
Min flying speed: F-30	18 kt (33 km/h; 20 mph)
F-30ES	20 kt (36 km/h; 22 mph)
Max rate of climb at S/L: F-30	366 m (1,200 ft)/min
Service ceiling: both	3,050 m (10,000 ft)
T-O run: both	31–76 m (100–250 ft)
Landing run: both	0–6 m (0–20 ft)

AIRDALE FLYER

AIRDALE FLYER COMPANY
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MARKETING MANAGER: Steve Winder

Airdale has expanded its portfolio with acquisition of established light aircraft which it markets in kit form. These are the South Korean (SkyGear) Comet; and the Avid Mk IV and Magnum, previously manufactured by Avid until its dissolution.
Still available is Airdale's Flyer, a development of John Larsen's Pursang which, itself, derived from the Avid Mk IV.

AIRDALE AVID FLYER MARK IV

TYPE: Side-by-side ultralight kitbuilt.
PROGRAMME: First flown 1983; available as single kit, or six separate kits to spread cost of purchase. Strongly influenced design of Indaer-Peru Chuspi light aircraft (see under Peru in 1992–93 *Jane's*), and the SkyStar series of kitbuilt aircraft, Avid **Bandit** identical, except for 454 kg (1,000 lb) maximum T-O weight. An upgrade kit for earlier Flyers is available, comprising a new, 40 cm (16 in) longer fuselage frame and associated components.
CUSTOMERS: More than 1,600 Avid Flyer kits delivered, with over 900 flying.
COSTS: Kit: High Gross STOL USD19,550. Aerobatic Speedwing USD19,500, both firewall back; upgrade kit USD7,995 (all 2006).
DESIGN FEATURES: Strut-braced, high-wing ultralight of traditional configuration and construction. Two forms available (interchangeable), as original **High Gross STOL** with unique near full-span auxiliary aerofoil flaperons, and shorter span **Aerobatic Speedwing** using new wing section: cruising and stalling speeds raised with Aerobatic Speedwing fitted. Wings fold for storage. Quoted build time 650 hours.
FLYING CONTROLS: Manual, Junkers flaperons (see Design Features), elevators with adjustable trim tab, and rudder.
STRUCTURE: Aluminium wing spars and plywood ribs, covered with heat-shrunk Dacron. Welded steel tube fuselage, rudder, tailplane and elevators, Dacron covered except for fuselage nose which has premoulded GFRP cowlings. Fin integral with fuselage.
LANDING GEAR: Fixed; tricycle or tailwheel type. Two faired-in side Vs hinged to lower longerons, plus half-axles sprung under centreline with bungee cord. Tundra tyres and brakes. Wheel rim size 12.7 cm (5 in). Steerable tailwheel. Optional Aqua 1500 floats, skis and wheel/skis. Wider landing gear available as option, introduced 2001.
POWER PLANT: One 47.8 kW (64.1 hp) Rotax 582 two-stroke engine, driving a two- or three-blade propeller; fixed-pitch wooden propeller for STOL, three-blade ground-adjustable for Speedwing. Fuel capacity 53 litres (14.0 US gallons; 11.7 Imp gallons) for High Gross STOL, and 68 litres (18.0 US gallons; 15.0 Imp gallons) for Aerobatic Speedwing; option to double capacity of each. Similar capacity fuel tanks may be added in port wing.



Avid Flyer Speedwing Mk 4 (Paul Jackson) 1158581

DIMENSIONS, EXTERNAL (A: STOL, B: Aerobatic Speedwing):

Wing span: A	9.11 m (29 ft 10½ in)
B	7.30 m (23 ft 11½ in)
Length overall	5.46 m (17 ft 11 in)
Height overall: tailwheel	1.80 m (5 ft 11 in)
tricycle	2.11 m (6 ft 11 in)
DIMENSIONS, INTERNAL:	
Cabin max width	1.00 m (3 ft 3½ in)
AREAS (A and B as above):	
Wings, gross: A	11.38 m² (122.5 sq ft)
B	9.04 m² (97.3 sq ft)
WEIGHTS AND LOADINGS (A and B as above):	
Weight empty: A	200–231 kg (440–510 lb)
B	231 kg (510 lb)
Max baggage weight	16 kg (35 lb)
Max T-O weight: A	522 kg (1,150 lb)
B	476 kg (1,050 lb)
PERFORMANCE (A and B as above):	
Max level speed at 1,525 m (5,000 ft):	
A, B	117 kt (217 km/h; 135 mph)
Max cruising speed: A	78 kt (145 km/h; 90 mph)
B	100 kt (185 km/h; 115 mph)
Stalling speed:	
A, flaps down, engine idling	28 kt (52 km/h; 32 mph)
B	37 kt (68 km/h; 42 mph)
Max rate of climb at S/L: A	518 m (1,700 ft)/min
B	366 m (1,200 ft)/min
Service ceiling: A, B	3,810 m (12,500 ft)
T-O run: A	27 m (90 ft)
B	38 m (125 ft)
Landing run: A	46 m (150 ft)
B	152 m (500 ft)
Range, no reserves: A	295 n miles (547 km; 340 miles)
B	491 n miles (910 km; 566 miles)

AIRDALE FLYER

TYPE: Side-by-side kitbuilt.
PROGRAMME: Designed by John Larsen in 1995 and initially known as the Pursang, itself a development of the Avid Flyer Mk IV Hauler, but with stretched fuselage and Subaru motorcar engine. Offered both as a kit and as an upgrade to existing aircraft.
CUSTOMERS: Four completed and flown by early 2004.
COSTS: Kit USD18,950; upgrade kit for Avid Flyer Mk IV USD7,995 (2004).
DESIGN FEATURES: Compared to Avid Flyer, has stretched fuselage to give better ground handling and range; re-raked windscreen; simplified control system with differential flaperon controls and redesigned cockpit area. Landing gear extensively redesigned with two-piece aluminium legs fitted into a box section that plugs into the bottom of the fuselage; if gear is damaged in a heavy landing the fuselage will not be distorted if the landing gear is twisted.
Quoted build time 500 hours.
FLYING CONTROLS: As Avid Flyer; differential flaperons.
STRUCTURE: As Avid Flyer; wing modified to allow increased MTOW.
LANDING GEAR: Tailwheel type; fixed. Superficially as Avid Flyer. Two-piece Grove aluminium landing gear; double tailsprings for better rough-terrain landings. Speed fairings.
POWER PLANT: Initial Pursang was powered by one 74.6 kW (100 hp) Subaru EA81 motorcar engine driving three-blade propeller; later power plants include Rotax and Teledyne Continental. Standard fuel capacity 106 litres (28.0 US gallons; 23.2 Imp gallons); can be increased to 136 litres (36.0 US gallons; 30.0 Imp gallons).
ACCOMMODATION: Compared to Avid Flyer, has redesigned windscreen and wider cockpit area; due to redesigned landing gear, tubes behind seating in Avid Flyer are no longer required, allowing easier access to larger baggage area; undersides reshaped to provide extra head and leg room. Wider cabin doors.

DIMENSIONS, EXTERNAL:

Wing span	9.14 m (30 ft 0 in)
Length overall	5.74 m (18 ft 10 in)
Height overall	1.75 m (5 ft 9 in)
Wheel track	1.88 m (6 ft 2 in)

AREAS:

Wings, gross	12.26 m ² (132.0 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	318 kg (700 lb)
Max T-O weight	635 kg (1,400 lb)
Max wing loading	51.8 kg/m ² (10.61 lb/sq ft)
Max power loading: EA81	8.52 kg/kW (14.00 lb/hp)

PERFORMANCE (74.6 kW; 100 hp EA81):

Max level speed (VNE)	117 kt (217 km/h; 135 mph)
Max cruising speed at 85% power	100 kt (185 km/h; 115 mph)
Normal cruising speed at 75% power	94 kt (174 km/h; 108 mph)
Stalling speed, power on: flaperons up	42 kt (78 km/h; 48 mph)
flaperons down	33 kt (60 km/h; 37 mph)
Max rate of climb at S/L	366 m (1,200 ft)/min
T-O to 15 m (50 ft)	244 m (800 ft)
Landing run	122 m (400 ft)
Range: with standard fuel	651 n miles (1,207 km; 750 miles)
with max fuel	869 n miles (1,609 km; 1,000 miles)

AIRDALE MAGNUM

TYPE: Side-by-side kitbuilt.

PROGRAMME: Development of original Avid Flyer.

CUSTOMERS: About 200 under construction with over 125 completed by mid 2006.

COSTS: Kit US\$26,990 without engine (2003).

DESIGN FEATURES: High-wing braced monoplane, similar to Flyer, but in certified category, using a Textron Lycoming engine. Recent upgrades include larger rudder and new external baggage door. Quoted build time 750 hours.

FLYING CONTROLS: Similar to Avid Flyer.

STRUCTURE: Similar to Avid Flyer, with Poly Fiber covering.

LANDING GEAR: Available as tricycle or tailwheel, with Cleveland wheels and brakes; wheel fairings. Spring aluminium landing gear standard. Optional floats.

POWER PLANT: One Textron Lycoming engine in 80.5 to 134 kW (108 to 180 hp) range, including O-235, O-320 and O-360. Tricycle version also accepts 119 kW (160 hp) Subaru EJ22 engine. Fuel capacity 110 litres (29.0 US gallons; 24.1 Imp gallons) of which 106 litres (28.0 US gallons; 23.3 Imp gallons) are usable. Optional 45 litre (12.0 US gallon; 10.0 Imp gallon) wingtip tanks available.

ACCOMMODATION: Two seats side by side, with dual controls, plus optional jump seat for small adult or two children in 0.81 m³ (28.5 cu ft) baggage area.

DIMENSIONS, EXTERNAL:

Wing span	10.06 m (33 ft 0 in)
Wing chord, constant	1.37 m (4 ft 6 in)
Wing aspect ratio	8.0
Width, wings folded	2.59 m (8 ft 6 in)
Length overall	6.40 m (21 ft 0 in)
Height overall	1.86 m (6 ft 1 1/4 in)

DIMENSIONS, INTERNAL:

Cabin max width	1.12 m (3 ft 8 in)
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AREAS:

Wings, gross	12.63 m ² (136.0 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	442 kg (975 lb)
Max baggage weight	68 kg (150 lb)
Max T-O weight	794 kg (1,750 lb)
Max wing loading	62.8 kg/m ² (12.87 lb/sq ft)
Power loading (119 kW; 160 hp)	6.66 kg/kW (10.94 lb/hp)

PERFORMANCE (119 kW; 160 hp O-320 engine):

Never-exceed speed (VNE)	134 kt (249 km/h; 155 mph)
Cruising speed	113 kt (209 km/h; 130 mph)
Stalling speed	31 kt (58 km/h; 36 mph)
Max rate of climb at S/L	549 m (1,800 ft)/min
Service ceiling	more than 6,100 m (20,000 ft)
T-O run	approx 46 m (150 ft)
T-O to 15 m (50 ft)	69 m (225 ft)
Landing run	76 m (250 ft)
Range	450 n miles (833 km; 517 miles)

AIR ELITE

AIR ELITE AVIATION

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PRESIDENT: Rodger Whaley

FINANCE MANAGER: Ashley Lyn Whaley

Air Elite is licensed by Prestige Aircraft Company of Jackson, Michigan, to distribute in North America the products of the Italian SG Aviation company, with which Prestige has a 30-year manufacturing agreement. The first US-built aircraft, a Rally, was exhibited at Sun 'n' Fun in April 2006. It is proposed to add indigenously built versions of the Storm (known in the US as Century) and Sea Storm to the portfolio. All are initially intended for the LSA market, with the Sea Storm later gaining FAR Pt 23 certification.

AIR ELITE STORM RALLY

TYPE: Two-seat lightplane.

PROGRAMME: Initial US-built Storm Rally, N337SP, demonstrated at Sun 'n' Fun, Lakeland, Florida, April 2006. Second followed four months later. Design granted LSA approval in 2006.

DESIGN FEATURES: As for Italian-manufactured aircraft, except that brakes and all appropriate fittings, fixings and bearings are of US dimensions and/or manufacture. As for SG Rally, except the following.

POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS2 flat-four driving a Warp Drive or Woodcomp three-blade, ground-adjustable pitch propeller through 1:2.43 reduction gear. Fuel capacity 133 litres (35.0 US gallons; 29.2 Imp gallons), of which 128 litres (34.0 US gallons; 28.3 Imp gallons) usable.

ACCOMMODATION: Two persons, side by side. Upward-hinged doors each side. Separate baggage compartment behind cockpit.

DIMENSIONS, EXTERNAL:

Wing span	8.71 m (28 ft 7 in)
Wing aspect ratio	6.4
Length overall	7.08 m (23 ft 2 3/4 in)
Height overall	2.31 m (7 ft 6 3/4 in)
Tailplane span	2.97 m (9 ft 9 in)
Propeller diameter: Woodcomp	1.78 m (5 ft 10 in)
Warp Drive	1.75 m (5 ft 9 in)
Passenger door: Height	0.99 m (3 ft 3 in)
Width	0.86 m (2 ft 10 in)

DIMENSIONS, INTERNAL:

Cockpit (instrument panel to rear bulkhead):	
Length	1.78 m (5 ft 10 in)
Max width	1.07 m (3 ft 6 in)
Max height (from seat)	1.02 m (3 ft 4 in)
Baggage compartment volume	0.45 m ³ (16.0 cu ft)

AREAS:

Wings, gross	11.86 m ² (127.7 sq ft)
--------------	------------------------------------

WEIGHTS AND LOADINGS:

Weight empty	345 kg (760 lb)
Max baggage weight	45 kg (100 lb)
Max T-O weight	598 kg (1,320 lb)
Max wing loading	50.5 kg/m ² (10.34 lb/sq ft)
Max power loading	8.15 kg/kW (13.38 lb/hp)

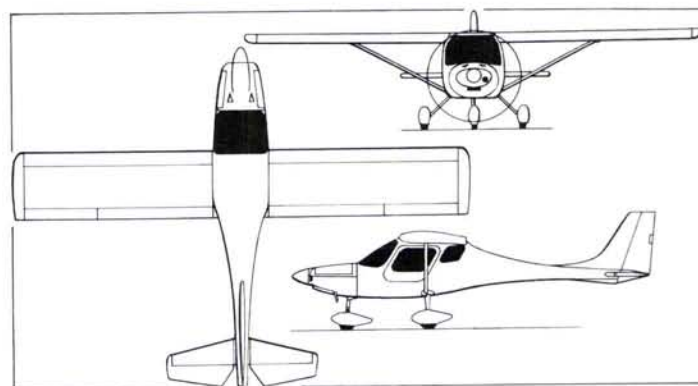
PERFORMANCE:

Never-exceed speed (VNE):	
aerodynamic	140 kt (259 km/h; 161 mph)



First Air Elite Storm Rally US-built version of SG Storm (Paul Jackson)

1159367



Air Elite Storm Rally (James Goulding)

1159393

LSA limit	120 kt (222 km/h; 138 mph)
Cruising speed at 75% power at 610 m (2,000 ft)	107 kt (198 km/h; 123 mph)
Stalling speed, power off: flaps up	44 kt (82 km/h; 51 mph)
flaps down	35 kt (65 km/h; 41 mph)
Max rate of climb at S/L	244 m (800 ft)/min
Service ceiling	3,660 m (12,000 ft)
T-O run	110 m (360 ft)
T-O to 15 m (50 ft)	183 m (600 ft)
Landing from 15 m (50 ft)	305 m (1,000 ft)
Landing run	138 m (450 ft)
Range with max fuel at 75% power	800 n miles (1,481 km; 920 miles)
Endurance	7 h 10 min
g limits	+4.4/-1.76

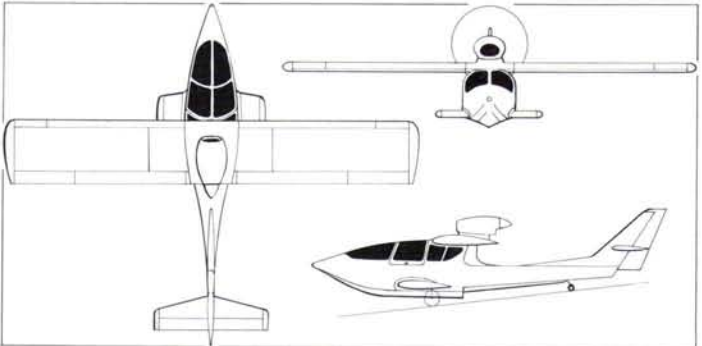
AIR ELITE SEASTORM

TYPE: Two-seat amphibian.

PROGRAMME: Derived by SG Aviation of Italy as Sea Storm from earlier ultralight version, with 59.7 kW (80 hp) engine and metal strut-braced wings, of which some 20 flying in Italy by 2002. First all-composites SG Sea Storm kitbuilt under construction in 2000/01 by SG's North American agent, Eric Dixon and first flew (N221ST) October 2001; later returned to



Italian-built SG Sea Storm two/four-seat amphibian (Geoffrey P Jones) 1044758



SG Sea Storm (James Goulding) 0093636

Italy, Ultralight Sea Storm with carbon wing and bracing struts under construction in 2003. Programme transferred to AirElite for potential manufacture as ready-to-fly LSA category amphibian under slightly revised name of SeaStorm; US LSA approval expected by end 2006.

Pending completion of US LSA trials, following data generally apply to former Italian-fabricated version.

CURRENT VERSIONS: **Z2:** Two-seat; baseline version.

Z4: Four-seat; increased wing span and power.

CUSTOMERS: Three sold in USA by April 2002; one Z2 to Australia in 2003, 26 sold (including earlier ultralight) by 2004, of which three then complete.

COSTS: Kit UL EUR34,600; Z2 EUR35,200. Z4 EUR38,900 (2005).

DESIGN FEATURES: High, constant-chord wing, moderately sweptback tailplane and highly sweptback fin; pusher propeller immediately aft of wing trailing-edge; mid-positioned stub-wing with stabilising floats. Quoted kit build time 700 hours.

Wing dihedral 0° 5'; incidence 2° 30'.

FLYING CONTROLS: Conventional and manual, Fowler flaps, Electric trim.

STRUCTURE: Composites fuselage and aluminium wing with main and rear spars.

LANDING GEAR: Optional retractable wheel landing gear attached immediately outboard of wingroots; 6.00-6 wheels.

POWER PLANT: One pusher piston/rotary engine.

Z2: Option of 73.5 kW (98.6 hp) Rotax 912 ULS or 84.6 kW (113.4 hp) Rotax 914 flat-four or 70.8 kW (95 hp) Mid-West AE 100 rotary driving an adjustable-pitch propeller. Textron Lycoming engines in the 82.0 to 119 kW (110 to 160 hp) range are also suggested. Standard fuel capacity 140 litres (37.0 US gallons; 30.8 Imp gallons), with optional extra 79 litre (20.9 US gallon; 17.4 Imp gallon) tanks available.

Z4: One 157 kW (210 hp) Textron Lycoming O-360; engines recommended in the range 149 to 224 kW (200 to 300 hp). Fuel capacity 200 litres (52.8 US gallons; 44.0 Imp gallons) as standard; optional 61 litre (16.1 US gallon; 13.4 Imp gallon) tanks available.

Ildrovatio hydraulic, flight-adjustable pitch, two- or three-blade propeller.

ACCOMMODATION: Two (side by side) or four persons in enclosed cabin with centreline-hinged door each side.

All data following (including dimensions) are approximate.

DIMENSIONS, EXTERNAL (A: Z2; B: Z4):

Wing span: A 9.60 m (31 ft 6 in)

B: 10.10 m (33 ft 1¾ in)

Length overall: A, B 7.44 m (24 ft 5 in)

Height overall: A, B 1.83 m (6 ft 0 in)

DIMENSIONS, INTERNAL:

Cabin max width: A, B 1.05 m (3 ft 5¼ in)

AREAS:

Wings, gross: A 12.96 m² (139.5 sq ft)

B 13.65 m² (146.9 sq ft)

WEIGHTS AND LOADINGS (A, B, as above):

Weight empty: A 510 kg (1,124 lb)

B 690 kg (1,521 lb)

Baggage capacity: A 30 kg (66 lb)

B 55 kg (121 lb)

Max T-O weight: A 810 kg (1,785 lb)

B 1,200 kg (2,645 lb)

Max wing loading: A 62.5 kg/m² (12.80 lb/sq ft)

B 87.9 kg/m² (18.01 lb/sq ft)

Max power loading:

A (Rotax 912) 11.02 kg/kW (18.11 lb/hp)

B (157 kW; 210 hp) 7.64 kg/kW (12.56 lb/hp)

PERFORMANCE (A, B, as above):

Never-exceed speed (VNE):

A 135 kt (250 km/h; 155 mph)

B 162 kt (300 km/h; 186 mph)

Max level speed: A 121 kt (225 km/h; 140 mph)

B 143 kt (265 km/h; 165 mph)

Cruising speed at 75% power at FL80:

A 111 kt (205 km/h; 127 mph)

B 125 kt (232 km/h; 144 mph)

Stalling speed:

flaps up: A 35 kt (64 km/h; 40 mph)

B 46 kt (85 km/h; 53 mph)

flaps down: A 33 kt (61 km/h; 38 mph)

B 40 kt (74 km/h; 46 mph)

Max rate of climb at S/L: A 240 m (787 ft)/min

B 330 m (1,082 ft)/min

Service ceiling: A 3,960 m (13,000 ft)

B 4,570 m (15,000 ft)

T-O run:

on land: A 180 m (591 ft)

B 220 m (722 ft)

on water: A 195 m (640 ft)

B 350 m (1,150 ft)

Landing run:

on land: A 200 m (656 ft)

B 250 m (820 ft)

on water: A 146 m (480 ft)

B 210 m (690 ft)

Range, no reserves:

A 917 n miles (1,700 km; 1,056 miles)

B 540 n miles (1,000 km; 621 miles)

g limits: A +4.2/-2.0

B +3.2/-1.8

AIRFRAMES

AIRFRAMES INC

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AIR TRACTOR

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PRESIDENT: Leland Snow

VICE-PRESIDENT, FINANCE: David Ickert

VICE-PRESIDENT, SALES: Kristin Edwards

Air Tractor agricultural aircraft based on 50-year experience of Leland Snow, who produced Snow S-2 series, which later became Rockwell S-2R; AT-300/301/302 (587 built) no longer in production; 2,000th aircraft delivered in 2002. Eight versions available, powered by various

Airframes (a certified repair station established in 1998) and its associate are manufacturers of kits and parts for the Piper Super Cub. They jointly offer the Super 18 kit, either complete for home builders or as selected components for refurbishment of Piper-built aircraft.

AIRFRAMES/DAKOTA SUPER 18

TYPE: Tandem-seat kitbuilt.

PROGRAMME: Description of Piper PA-18 Super Cub Crafters entry in US section of *Jane's All the World's Aircraft*. Super 18 is broadly similar.

COSTS: Kit USD33,530, excluding engine and avionics (2006).

P&W PT6A and R-1340 engines. Company now has 180 employees and total of 13,660 m² (147,000 sq ft) of manufacturing space at three plants.

AIR TRACTOR AT-401 AIR TRACTOR

TYPE: Agricultural sprayer.

PROGRAMME: AT-401 developed 1986 from AT-301, with increased wing span and larger hopper. AT-401A version with Polish PZL-3S radial engine abandoned, with just one aircraft produced. AT-401B version replaced the 401 and has Hoerner wingtips and increased wing span.

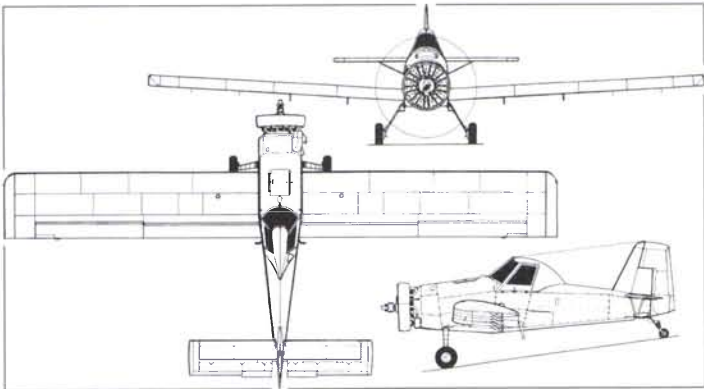
CURRENT VERSIONS: **AT-401B:** Standard version: as described.

Increased T-O weight: Optional version with landing gear of AT-402A and 517 kg (1,140 lb) of additional disposable load.



Radial-engined Air Tractor AT-401 agricultural sprayer

1195989



Air Tractor AT-401B (Pratt & Whitney R-1340 radial engine) (Paul Jackson)

1158972

CUSTOMERS: By December 2005, 198 AT-401s, one AT-401A and 77 AT-401Bs delivered to Argentina, Australia, Brazil, Canada, Colombia, Mexico, Spain and US. Production of AT-400/400A totalled 72 and 14, respectively.

COSTS: Standard AT-401B USD277,500; with customer-supplied engine USD235,300 (both 2004).

DESIGN FEATURES: Purpose-designed sprayer with cantilever low wing and hopper at CG. Constant-chord, unswept wings and tailplane; latter braced; moderately sweptback fin. High-mounted cockpit with protective reinforcement.

Wing aerofoil NACA 4415; dihedral 3° 30'; incidence 2°.

FLYING CONTROLS: Conventional and manual. Balance tabs on ailerons, elevators and rudders; ailerons droop 10° when electrically operated Fowler flaps deflected to their maximum of 26°.

STRUCTURE: Two-spar wing structure of 2024-T3 light alloy, with alloy steel lower spar cap; bonded doubler inside wing leading-edge to resist impact damage; glass fibre wingroot fairings and skin overlaps sealed against chemical ingress; wing ribs and skins zinc chromated before assembly; flaps and ailerons of light alloy. Fuselage of 4130N steel tube, oven stress relieved and oiled internally, with skin panels of 2024-T3 light alloy attached by Camloc fasteners for quick removal; rear fuselage lightly pressurised to prevent chemical ingress; cantilever fin and strut-braced tailplane of light alloy, metal-skinned and sealed against chemical ingress.

LANDING GEAR: Tailwheel type; fixed. Fuselage-mounted, cantilever heavy-duty E-4340 spring steel main gear, thickness 28.6 mm (1.125 in); flat spring suspension for castoring and lockable tailwheel, Cleveland mainwheels with tyre size 8.50-10 (8 ply), pressure 2.83 bar (41 lb/sq in). Tailwheel tyre size 5.00-5. Cleveland four-piston brakes with heavy-duty discs. Optional AT-402A-type landing gear.

POWER PLANT: One remanufactured 447 kW (600 hp) Pratt & Whitney R-1340 air-cooled radial engine with speed ring cowling or optional RamAir Scoopkit, driving a Hamilton Sundstrand 12D40/6101A-12 two-blade propeller; optional propellers include a Pacific Propeller 22D40/AG200-2 Hydromatic two-blade constant-speed metal and Hydromatic 23D40 three-blade propeller. Air Tractor has designed and is producing new FAA-approved replacement crankshaft for R-1340; other new replacement parts available include main and thrust bearings, and blower (impeller) bearings. Over 300 replacement crankshafts delivered by early 1997. 477 litre (126 US gallon; 105 Imp gallon) fuel tanks. Oil capacity 30 litres (8.0 US gallons; 6.7 Imp gallons). Orenda OE600 V-8 liquid-cooled piston engine of 447 kW (600 hp) tested in December 1999; development towards certification continued, with aim of deliveries during 2001.

ACCOMMODATION: Single seat with nylon mesh cover in enclosed cabin which is sealed to prevent chemical ingress. Downward-hinged window/door on each side. 'Line of sight' instrument layout, with swing-down lower instrument panel for ease of access for instrument maintenance. Baggage compartment in bottom of fuselage, aft of cabin, with door on port side. Cabin ventilation by 0.10 m (4 in) diameter air scoop.

SYSTEMS: 24 V electrical system, supplied by 35 A engine-driven alternator; 60 A alternator optional.

AVIONICS: Optional avionics include Bendix/King KX 155 nav/com/glide slope and ACK E-01 emergency locator transmitter.

EQUIPMENT: Agricultural dispersal system comprises a 1,514 litre (400 US gallon; 333 Imp gallon) Derakane vinyl ester resin/glass fibre hopper mounted in forward fuselage with hopper window and instrument panel-mounted hopper quantity gauge; 0.97 m (3 ft 2 in) wide Transland gatebox; Transland 5 cm (2 in) bottom loading valve; Agrinautics 6.4 cm (2½ in) sprayspump with Transland on/off valve and five-blade variable-pitch plastics fan, and 38-nozzle stainless steel spray system with streamlined booms; swath width 24.39 m (80 ft 0 in). Ground start receptacle and hopper rinse system are standard.

Optional equipment includes night flying package comprising strobe and navigation lights, night working lights, retractable 600 W landing light in port wingtip; and ferry fuel system. Alternative agricultural equipment includes Transland 22358 extra high-volume spreader, Transland 54401 NorCal Swathmaster, and 40 extra spray nozzles for high-volume spraying. Three-piece safety plate glass centre windshield and washer system optional, as is a new crew seat.

DIMENSIONS, EXTERNAL:

Wing span 15.57 m (51 ft 1¼ in)
Wing chord, constant 1.83 m (6 ft 0 in)

Wing aspect ratio 8.5
Length overall 8.23 m (27 ft 0 in)
Height overall 2.59 m (8 ft 6 in)
Propeller diameter: standard 2.77 m (9 ft 1 in)
optional 2.59 m (8 ft 6 in)

AREAS:

Wings, gross 28.43 m² (306.0 sq ft)
Ailerons (total) 3.55 m² (38.20 sq ft)
Trailing-edge flaps (total) 3.75 m² (40.40 sq ft)
Fin 0.90 m² (9.70 sq ft)
Rudder 1.30 m² (14.00 sq ft)
Tailplane 2.42 m² (26.00 sq ft)
Elevators, incl tabs 2.36 m² (25.40 sq ft)

WEIGHTS AND LOADINGS (S: standard, IGW: increased gross weight):

Weight empty, spray equipped 1,925 kg (4,244 lb)
Max T-O weight: S 3,565 kg (7,860 lb)
IGW 4,082 kg (9,000 lb)
Max landing weight: S 2,721 kg (6,000 lb)
IGW 3,175 kg (7,000 lb)
Max wing loading: S 125.4 kg/m² (25.69 lb/sq ft)
IGW 143.6 kg/m² (29.41 lb/sq ft)
Max power loading: S 7.97 kg/kW (13.10 lb/hp)
IGW 9.13 kg/kW (15.00 lb/hp)

PERFORMANCE (at standard max T-O weight, except where indicated):

Max cruising speed at S/L, hopper empty 135 kt (251 km/h; 156 mph)
Cruising speed at FL40 124 kt (230 km/h; 143 mph)
Typical working speed 104–122 kt (193–225 km/h; 120–140 mph)
Stalling speed at 2,721 kg (6,000 lb) ATW:
flaps up 64 kt (118 km/h; 73 mph)
flaps down 53 kt (99 km/h; 61 mph)
Stalling speed as usually landed 47 kt (87 km/h; 54 mph)
Max rate of climb at S/L:
at max landing weight 335 m (1,100 ft)/min
at max T-O weight 158 m (520 ft)/min
T-O run 402 m (1,320 ft)
Range at econ cruising speed at FL80, no reserves 547 n miles (1,014 km; 630 miles)

AIR TRACTOR AT-402 TURBO AIR TRACTOR

TYPE: Agricultural sprayer.

PROGRAMME: Follow-on from AT-400 of 1980. AT-402 first flight August 1988; certified November 1988; first delivery late 1988. Current 402A and 402B have Hoerner wingtips and increased span.

CURRENT VERSIONS: **AT-402A:** Introduced in mid-1997, supplementing AT-402B, powered by a 410 kW (550 shp) P&WC PT6A-11AG. Aimed at first-time turbine buyer and priced accordingly, complete with spray dispersal equipment, lights and air conditioning.

AT-402B: Combines fuselage, tail surfaces and landing gear of AT-400 with turboprop engine and wing of AT-401B.

Description refers to AT-402B, and is generally as for AT-401, except that below.

CUSTOMERS: Total of 68 AT-402s, 112 AT-402As and 46 AT-402Bs delivered by December 2005. Production continuing at about 10 per year.

COSTS: Standard AT-402A with PT6A-11AG USD499,900; standard AT-402B USD599,500; or USD284,500 with customer-supplied PT6A-15AG, -27, -28 or -34AG engine (2006).

DESIGN FEATURES: Broadly as AT-401. All versions have steel alloy lower wing spar caps for long fatigue life and reinforced leading-edges to prevent birdstrike damage. Size 29x11.0-10 high-flotation tyres and wheels as standard.

POWER PLANT: One 507 kW (680 shp) P&WC PT6A-15AG, -27 or -28 turboprop, either new or customer-furnished, driving a Hartzell HCB3TN-3D/T1028N+4 three-blade constant-speed reversible-pitch propeller. Standard fuel capacity 644 litres (170 US gallons; 142 Imp gallons); optional fuel tankage 818 litres (216 US gallons; 180 Imp gallons) or 886 litres (234 US gallons; 195 Imp gallons).

SYSTEMS: 250 A starter/generator and two 24 V 21 Ah batteries.

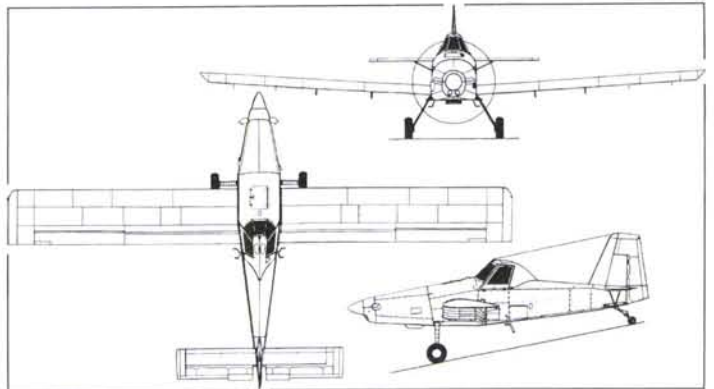
EQUIPMENT: Hopper and gatebox size as for AT-401; optional equipment includes Transland extra high-volume dispersal system; engine-driven air conditioning system.

DIMENSIONS, EXTERNAL:

Length overall 9.32 m (30 ft 7 in)
Height: propeller turning 3.40 m (11 ft 2 in)
to top of cockpit 2.90 m (9 ft 6 in)
Tailplane span 5.23 m (17 ft 2 in)
Wheel track 2.62 m (8 ft 7 in)

WEIGHTS AND LOADINGS:

Weight empty, spray equipped, both 1,783 kg (3,930 lb)
Certified gross weight (FAR Pt 23) 3,175 kg (7,000 lb)
Typical operating weight (CAM 8):
AT-402A 3,901 kg (8,600 lb)
AT-402B 4,159 kg (9,170 lb)
Max landing weight, both 3,175 kg (7,000 lb)
Max wing loading 137.2 kg/m² (28.10 lb/sq ft)
Max power loading 7.70 kg/kW (12.65 lb/shp)



Air Tractor AT-402A/AT-402B Turbo Air Tractor (Paul Jackson)

1158971



Air Tractor AT-402A Turbo Air Tractor

1195990

PERFORMANCE:

Max level speed at S/L:	
clean	174 kt (322 km/h; 200 mph)
with dispersal equipment	160 kt (298 km/h; 185 mph)
Cruising speed at 283 kW (380 shp) at FL80	142 kt (264 km/h; 164 mph)
Typical working speed	113–126 kt (209–233 km/h; 130–145 mph)
Stalling speed at 2,721 kg (6,000 lb) AUV:	
flaps up	64 kt (118 km/h; 73 mph)
flaps down	53 kt (99 km/h; 61 mph)
Stalling speed at 2,041 kg (4,500 lb) typical landing weight	46 kt (86 km/h; 53 mph)
Max rate of climb at S/L, dispersal equipment installed:	
AUV of 2,721 kg (6,000 lb)	495 m (1,625 ft)/min
AUV of 3,565 kg (7,860 lb)	320 m (1,050 ft)/min
T-O run at 3,565 kg (7,860 lb) AUV	247 m (810 ft)
Landing run at 2,041 kg (4,500 lb) AUV	122 m (400 ft)
Range at econ cruising speed at FL80, no reserves	573 n miles (1,062 km; 660 miles)

AIR TRACTOR AT-502 TURBO

TYPE: Agricultural sprayer.
PROGRAMME: Developed as stretched AT-401. First flight of AT-502 April 1987; certified 23 June 1987.

CURRENT VERSIONS: **AT-502:** Original version.
Description refers to AT-502, and is generally as for AT-401, except that below.
AT-502A: Similar to AT-502B but with 820 kW (1,100 shp) PT6A-45R; slow turning (1,425 rpm) five-blade Hartzell (HCB5MP-3C/M10876AS) propeller; enlarged vertical tail surfaces. For operation in mountainous terrain or short strips. Prototype first flight February 1992; certified April 1992; 26 delivered by end 2005.
AT-502B: Stronger wing than AT-502, with 0.61 m (2 ft) longer span and Hoerner wingtips, which are stated to increase width of spray pattern by 0.91 m (3 ft); 349 delivered by end of 2005.
AT-503A: Dual control, tandem-seat trainer; PT6A-34AG engine. Prototype designated AT-503. In low-rate production.

CUSTOMERS: Total of 595 AT-500 series delivered by end of 2005, including out-of-production AT-501 (nine), AT-502 (208), AT-503 (one), plus AT-503A (three). Recent deliveries to Argentina, Australia, Brazil and US.

COSTS: Standard AT-502B USD654,900 with PT6A-15AG, or USD703,900 with-34AG; or USD334,500 with customer-supplied PT6A-15AG, -27, -28, -34AG (2004).

DESIGN FEATURES: See AT-401. 1,892 litre (500 US gallon; 416 Imp gallon) hopper handles low-density nitrogen-based fertilisers such as urea; safety glass centre windscreen with wiper. Alloy steel lower spar cap and bonded doubler on inside of wing leading-edge for increased resistance to impact damage, and glass fibre wingroot fairings.

LANDING GEAR: Tailwheel type; fixed. Fuselage-mounted, heavy-duty E-4340 spring steel main gear, thickness 37.2 mm (1.31 in); flat spring for castoring and lockable tailwheel. Cleveland mainwheels, with high-flotation tyres size 29x11.0–10, pressure 3.45 bar (50 lb/sq in); tailwheel tyre size 5.00–5; Cleveland six-piston brakes with heavy-duty discs.

POWER PLANT: One 507 kW (680 shp) Pratt & Whitney Canada PT6A-15AG, PT6A-27 or PT6A-28, or 559 kW (750 shp) PT6A-34 or PT6A-34AG turboprop, driving a Hartzell HCB3TN-3D/T10282+4 three-blade metal propeller. Standard fuel capacity 644 litres (170 US gallons; 142 Imp gallons). Optional capacities 818 litres (216 US gallons; 180 Imp gallons) and 886 litres (234 US gallons; 195 Imp gallons). AT-502A has 818 litre (216 US gallon; 180 Imp gallon) tanks as standard.

ACCOMMODATION: One or two persons (see Current Versions). Has quickly detachable instrument panel and removable fuselage skin panels for ease of maintenance.

SYSTEMS: Three 24 V 42 Ah batteries and 250 A starter/generator.

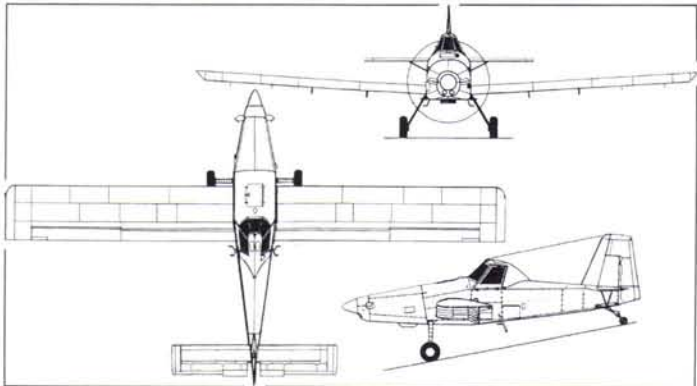
AVIONICS: *Comms:* Optional avionics include Bendix/King KX 155 nav/com/glideslope and KR 87 ADF, KY 196 VHF radio, KT 76A transponder and ACK E-01 emergency locator transmitter.

EQUIPMENT: Agricultural dispersal system comprises a 1,892 litre (500 US gallon; 416 Imp gallon) hopper mounted in forward fuselage with hopper window and instrument panel-mounted hopper quantity gauge; 0.97 m (3 ft 2 in) wide Transland gatebox; Transland 6.4 cm (2½ in) bottom loading valve; Agrinautics 6.4 cm (2½ in) spraypump with Transland on/off valve and five-blade variable-pitch plastics fan and 38-nozzle stainless steel spray



Air Tractor AT-502 agricultural sprayer

1195992



Air Tractor AT-502B agricultural aircraft (Paul Jackson)

1158970

system with streamlined booms. Optional dispersal equipment includes 7.6 cm (3 in) spray system with 119 spray nozzles, and automatic flagman; spray swath 25.91 m (85 ft 0 in).
Standard equipment includes safety glass centre windscreen panel, ground start receptacle, three-colour polyurethane paint finish, strobe and navigation lights; windscreen washer and wiper; and twin nose-mounted landing/taxi lights. Optional equipment includes engine-driven air conditioning system, night flying package, comprising night working lights, retractable 600 W landing light in port wingtip; fuel flowmeter, fuel totaliser and ferry fuel system. Alternative agricultural equipment includes Transland 22356 extra high-volume spreader, Transland 54401 NorCal Swathmaster, 40 extra spray nozzles for high-volume spraying, and eight- or 10-unit Micronair Mini Atomiser unit; hopper rinse tank is standard. New crew seat is also optional.

DIMENSIONS, EXTERNAL:

Wing span: AT-502A/502B	15.85 m (52 ft 0 in)
AT-502	15.24 m (50 ft 0 in)
Wing chord, constant	1.83 m (6 ft 0 in)
Wing aspect ratio	8.7
Length overall	10.11 m (33 ft 2 in)
Height: propeller turning	3.63 m (11 ft 11 in)
to top of cockpit	3.12 m (10 ft 3 in)
Tailplane span	5.23 m (17 ft 2 in)
Wheel track	3.12 m (10 ft 3 in)
Wheelbase	6.64 m (21 ft 9½ in)
Propeller diameter: AT-502B	2.69 m (8 ft 10 in)

AREAS:	
Wings, gross: AT-502A/502B	28.99 m ² (312.0 sq ft)
AT-502	27.87 m ² (300.0 sq ft)
Ailerons (total)	3.53 m ² (38.0 sq ft)
Trailing-edge flaps (total)	3.75 m ² (40.4 sq ft)
Fin	0.90 m ² (9.7 sq ft)
Rudder	1.30 m ² (14.0 sq ft)
Tailplane	2.41 m ² (26.0 sq ft)
Elevators (total, incl tab)	2.44 m ² (26.3 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty, spray equipped	1,949 kg (4,297 lb)
Max T-O weight	4,399 kg (9,700 lb)
Max landing weight	3,629 kg (8,000 lb)
Max wing loading:	
AT-502A/502B	151.8 kg/m ² (31.09 lb/sq ft)
Max power loading: 502A	5.37 kg/kW (8.82 lb/shp)
502B (PT6A-34AG)	7.87 kg/kW (12.93 lb/shp)
502B (PT6A-15AG)	8.68 kg/kW (14.26 lb/shp)
PERFORMANCE (AT-502B with spray equipment installed):	
Never-exceed speed (VNE) and max level speed at S/L, hopper empty	156 kt (290 km/h; 180 mph)
Cruising speed at FL80, 283 kW (380 shp)	136 kt (253 km/h; 157 mph)
Typical working speed	104–126 kt (193–233 km/h; 120–145 mph)
Stalling speed at 3,629 kg (8,000 lb) AUW:	
flaps up	72 kt (132 km/h; 82 mph)
flaps down	59 kt (110 km/h; 68 mph)
Stalling speed at 1,978 kg (4,360 lb) typical landing weight	46 kt (86 km/h; 53 mph)
Max rate of climb at S/L, AUW of 3,629 kg (8,000 lb):	
with PT6A-15AG	311 m (1,020 ft)/min
with PT6A-34AG	360 m (1,180 ft)/min
Max rate of climb at S/L, AUW of 4,309 kg (9,500 lb):	
with PT6A-15AG	232 m (760 ft)/min
with PT6A-34AG	282 m (925 ft)/min
T-O run at AUW of 3,629 kg (8,000 lb):	
with PT6A-15AG	236 m (775 ft)
with PT6A-34AG	222 m (730 ft)
T-O run at AUW of 4,309 kg (9,500 lb):	
with PT6A-15AG	356 m (1,170 ft)
with PT6A-34AG	302 m (990 ft)
Range with max fuel	538 n miles (998 km; 620 miles)

AIR TRACTOR AT-602

TYPE: Agricultural sprayer.

PROGRAMME: Prototype first flew 1 December 1995. Certification completed 6 June 1996 and deliveries began the following month. Aircraft fits into Air Tractor range between AT-502B and AT-802A, being AT-502 with increased wing and tail spans, plus taller fin.

CUSTOMERS: Total of 141 produced by end of 2005.

COSTS: Standard AT-602 with PT6A-60AG USD925,000; with customer-supplied engine USD410,900 (2004).

Description generally as for AT-401, except that following.

POWER PLANT: Choice of 783 kW (1,050 shp) Pratt & Whitney Canada PT6A-60AG turboprop, or PT6A-65AG of 966 kW (1,295 shp), driving a Hartzell five-blade constant-speed reversing propeller. Fuel capacity 818 litres (216 US gallons; 180 Imp gallons); optional fuel capacity 1,105 litres (292 US f; 243 Imp gallons).

EQUIPMENT: Glass fibre hopper, capacity 2,385 litres (630 US gallons; 525 Imp gallons); Transland 0.96 m (3 ft 2 in) wide gatebox; five-blade ground-adjustable spraypump fan; pump shut-off valve. Optional crew seat.

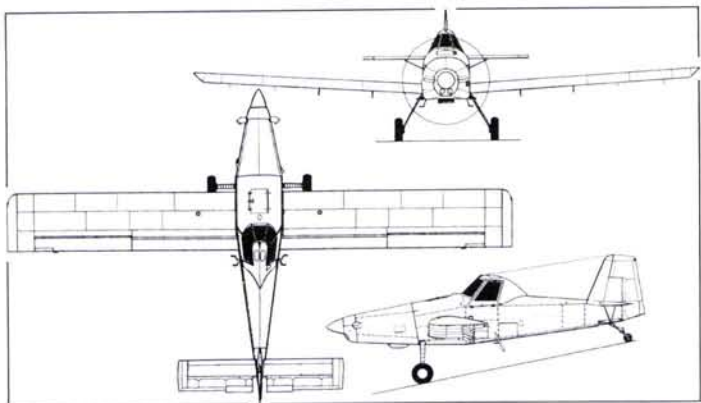
DIMENSIONS, EXTERNAL:

Wing span	17.07 m (56 ft 0 in)
Wing chord, constant	1.83 m (6 ft 0 in)
Wing aspect ratio	9.3



Air Tractor AT-602

1195094



Air Tractor AT-602 (P&WC PT6A-60AG engine) (Paul Jackson)

1158969

Length overall	10.41 m (34 ft 2 in)
Height: propeller turning	3.71 m (12 ft 2 in)
to top of fin	3.38 m (11 ft 1 in)
to top of cockpit	3.17 m (10 ft 5 in)
Tailplane span	5.66 m (18 ft 7 in)
Wheel track	3.07 m (10 ft 1 in)
Wheelbase	6.71 m (22 ft 0 in)

AREAS:	31.22 m ² (336.0 sq ft)
Wings, gross	

WEIGHTS AND LOADINGS:	
Weight empty, equipped	2,540 kg (5,600 lb)
Max T-O weight	5,670 kg (12,500 lb)
Max landing weight	5,443 kg (12,000 lb)
Max wing loading	181.6 kg/m ² (37.20 lb/sq ft)
Max power loading	7.25 kg/kW (11.90 lb/shp)

PERFORMANCE:	
Never-exceed speed (VNE)	189 kt (350 km/h; 217 mph)
Working speed	130 kt (241 km/h; 150 mph)
Stalling speed: flaps up	86 kt (160 km/h; 99 mph)
flaps down	75 kt (139 km/h; 87 mph)

AIR TRACTOR AT-802

TYPE: Agricultural sprayer.

PROGRAMME: Design started July 1989; optional configuration as firefighter; first flight of prototype (N802LS) 30 October 1990; second aircraft flew November 1991, with PT6A-45R and configured as agricultural model with spraybooms, pump and Transland gatebox. Production deliveries started second quarter 1993.

CURRENT VERSIONS: **AT-802:** Tandem two-seater powered by P&WC PT6A-45R; certified for gross weight of 6,804 kg (15,000 lb) 27 April 1993. PT6A-65AG and -67AG versions certified April 1993 at maximum T-O weight of 7,257 kg (16,000 lb).

AT-802A: Single-seat version; third production aircraft in this configuration; can be powered by refurbished PT6A-65AG or -67AG engine. First flight 6 July 1992; FAA certification gained 17 December 1992; certified for gross weight of 6,804 kg (15,000 lb) with PT6A-45R on 27 April 1993. PT6A-65AG versions certified March 1993 at maximum T-O weight of 7,257 kg (16,000 lb).

AT-802AF Fire Boss: Amphibious firefighting version; Wiplane amphibious floats with water-scooping capability.

AT-802F: Two-seat firefighting version; PT6A-67AG engine. FAA certification at 5,670 kg (12,500 lb) maximum T-O weight 17 December 1992; certified at 7,257 kg (16,000 lb) on 27 April 1993, giving useful load of 3,987 kg (8,790 lb).

Data apply to AT-802F version, except where indicated.

CUSTOMERS: Total 225 registered by December 2005. Deliveries include two to Saudi Arabia for oil slick eradication. More than 120 engaged in firefighting duties in six countries during 2006. Recent customers include Compañía de Extinción General de Incendios SA (CEGISA) of Spain, which purchased the first two production AT-802AF Fire Bosses in late 2003, leasing one to Conair of Canada; several more followed in 2004. Forest Protection Limited (FPL) of New Brunswick, Canada, which ordered six AT-802Fs, one purchased after lease during 2001, two for delivery in 2002 and three delivered in 2003, to replace Grumman Avenger firebombers; and the US State Department's International Narcotics and Law Enforcement Division, which operates 13 AT-802s, for drug eradication duties in Colombia in a joint programme with the Colombian National Police. These aircraft are modified with self-sealing fuel tanks, armoured engine compartments and cockpits, with bulletproof windscreens, engine fire-extinguishing systems; oxygen system, GPS and HF radios.

COSTS: Standard AT-802A USD1,093,900 with new PT6A-65AG; with customer-supplied PT6A-65AG or -67AG USD516,900. Standard AT-802AF USD1,372,900 with PT6A-67AG; or USD691,500 with customer-supplied PT6A-67AG. Two-seat version with dual controls USD33,500 extra (all 2006).

DESIGN FEATURES: Generally as for AT-401. Largest aircraft built by company to date; full dual controls for training; also designed for firefighting; programmable logic computer with cockpit control panel and digital display enables pilot to select coverage level and opens hydraulically operated 'bomb bay' drop doors to prescribed width, closing them when selected amount of retardant released. Drop doors adjust automatically for changing head pressure and aircraft acceleration to provide a constant flow rate and even ground coverage. Wing aerofoil section NACA 4415; dihedral 3° 30'; incidence 2°.

FLYING CONTROLS: Manually operated ailerons, elevators and rudder with balance tabs; electrically operated Fowler trailing-edge flaps deflect to maximum 30°.

STRUCTURE: Two-spar wing of 2024-T3 light alloy with alloy steel upper and lower spar caps and bonded doubler on inside of leading-edge for impact damage resistance; ribs and skins zinc chromated before assembly; glass fibre wingroot fairing and skin overlaps sealed against chemical ingress; flaps and ailerons of light alloy. Fuselage of welded 4130N steel tube, oven stress relieved and oiled internally, with skin panels of 2024-T3 light alloy attached by Camloc fasteners for quick removal; rear fuselage lightly pressurised to prevent chemical ingress. Cantilever fin and strut-braced tailplane of light alloy, metal skinned and sealed against chemical ingress.

LANDING GEAR: Tailwheel type; fixed. Fuselage-mounted, cantilever heavy-duty E-4340 spring steel main legs, thickness 44.5 mm (1.75 in); flat spring suspension for castoring and lockable tailwheel. Cleveland mainwheels with tyre size 11.00-12 (10 ply), pressure 4.14 bar (60 lb/sq in). Tailwheel tyre size 6.00-6. Cleveland eight-piston brakes with heavy-duty discs.

POWER PLANT: One Pratt & Whitney Canada PT6A-65AG or -67AG turboprop, rated at 966 kW (1,295 shp) for -65AG and 1,007 kW (1,350 shp) for -67AG, both driving a Hartzell five-blade feathering and reversible-pitch constant-speed metal propeller. Fuel in two integral wing tanks, total usable capacity 961 litres (254 US gallons; 211 Imp gallons); optional tanks increase capacity to 1,438 litres (380 US gallons; 317 Imp gallons). Engine air is filtered through two large pleated paper industrial truck filters.

ACCOMMODATION: One or two seats in enclosed cabin, which is sealed to prevent chemical ingress and protected with overturn structure. Four downward-hinged doors, two on each side. Windscreen is safety-plate auto glass, with washer and wiper. Air conditioning system standard.

SYSTEMS: Hydraulic system, pressure 207 bar (3,000 lb/sq in).

AVIONICS: Choice of avionics suites by Bendix/King and Garmin.

Comms: Bendix/King KX 155A nav/com; KY 99A or KY 196A transceivers; KIX 135 GPS/com; KT 76A transponder; KMA 24H audio control panel; Garmin GNS 430 or GNS 530 nav/com/GPS; GTX 320 transponder; GMA 340 audio panel.

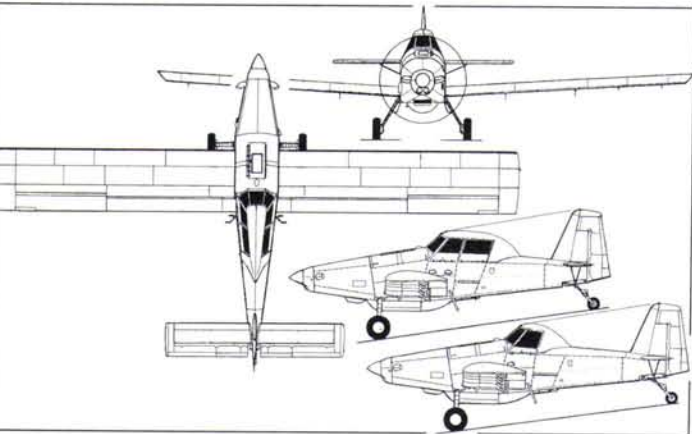
Flight: Bendix/King KT 87 ADF; KCS 55A compass; KN 64 DME.

EQUIPMENT: Two removable Derakane vinyl ester hoppers forward of cockpit and 227 litre (60 US gallon; 50 Imp gallon) gate tank in ventral bulge, for agricultural chemical, fire retardant



Air Tractor AT-802 at work

1195996



Air Tractor AT-802 two-seat agricultural aircraft with extra side view (lower) of AT-802A single-seater (Paul Jackson)

1158968

or water: total capacity 3,028 litres (800 US gallons; 666 Imp gallons). Electronic spray monitoring system standard. Transland high-volume fertilising gate 0.96 x 0.25 m (3 ft 2 in x 10 in) optional.

DIMENSIONS, EXTERNAL:

Wing span	17.68 m (58 ft 0 in)
Wing chord, constant	2.07 m (6 ft 9½ in)

Wing aspect ratio	8.4
Length overall	10.95 m (35 ft 11 in)
Height overall	3.89 m (12 ft 9 in)
Tailplane span	6.03 m (19 ft 9½ in)
Wheel track	3.10 m (10 ft 2 in)
Wheelbase	7.25 m (23 ft 9½ in)
Propeller diameter (-65AG)	2.92 m (9 ft 7 in)

AREAS:

Wings, gross	37.25 m² (401.0 sq ft)
Ailerons (total)	4.61 m² (49.60 sq ft)
Trailing-edge flaps (total)	5.54 m² (59.60 sq ft)
Fin	1.24 m² (13.40 sq ft)
Rudder	1.57 m² (16.90 sq ft)
Tailplane	3.44 m² (37.00 sq ft)
Elevators (total, incl tab)	3.00 m² (32.30 sq ft)

WEIGHTS AND LOADINGS (AT-802A):

Weight empty, equipped: sprayer	2,867 kg (6,320 lb)
firefighter	3,270 kg (7,210 lb)
Max T-O and landing weight	7,257 kg (16,000 lb)
Max wing loading	194.8 kg/m² (39.90 lb/sq ft)
Max power loading (-67AG)	7.21 kg/kW (11.85 lb/shp)

PERFORMANCE:

Max level speed at S/L	182 kt (338 km/h; 210 mph)
Max cruising speed at FL80	192 kt (356 km/h; 221 mph)
Stalling speed, power off, flaps down, at max landing weight	79 kt (147 km/h; 91 mph)
Max rate of climb at S/L	259 m (850 ft)/min
Service ceiling	3,965 m (13,000 ft)
T-O run	610 m (2,000 ft)
Range with max fuel	696 n miles (1,289 km; 800 miles)

ALGIE

ALGIE COMPOSITE AIRCRAFT

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PROPRIETOR: David Algie

Mr Algie has applied his considerable experience of motorsport engineering to the design of a homebuilt aircraft which will be made available as an easy-assembly kit, powered by a motorcar engine.

ALGIE LP-1

TYPE: Side-by-side sportplane kitbuilt.

PROGRAMME: Elements of prototype displayed at AirVenture, Oshkosh, in July 2005. By September 2006, prototype estimated to be 20 months from first flight.

COSTS: Kit USD55,000, less engine and avionics (2006).

DESIGN FEATURES: High performance lightplane, suitable for air racing, powered by converted motorcar engine.

Wing section Riblett GA40A-215.

FLYING CONTROLS: Conventional and manual.

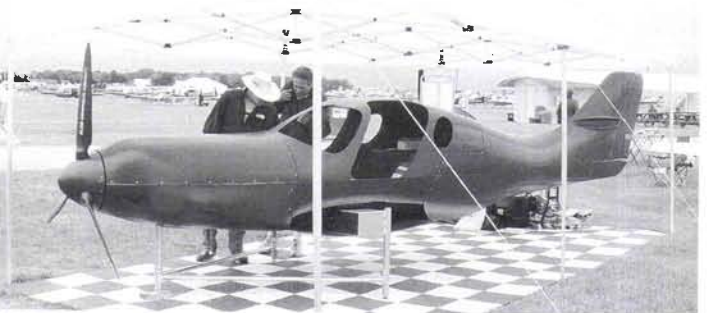
STRUCTURE: Generally of carbon fibre composites. Designed to assemble "like a scale plastic model": no fillet cover panels, as each part has half fillet built in; all fuselage components connect with knuckle joints for accurate alignment. Pressurised cockpit is a two-piece moulding including front and rear bulkheads. Elliptical planform wing houses four lightweight fuel bladders for improved fire prevention. Ribless wing uses Nomex honeycomb skins for structural support. Main and secondary spars are integral part of the

skin and bond at the horizontal joint in the middle, as do horizontal and vertical stabilizer spars. Skin thus a true spar cap using unidirectional carbon for maximum strength and light weight.

Main and secondary spar carry-throughs in the cockpit are moulded-in to ensure accurate spar and wing fitting from below; also that the cockpit is sealed and that the fuselage can not expand due to internal pressurisation. Cockpit door is also integrally laid-up and of 'plug' type to withstand 0.7 bar (10 lb/sq in) differential pressure at FL300.

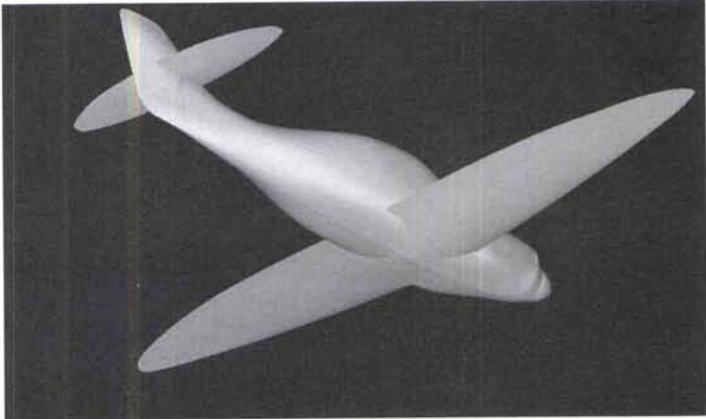
Main landing gear attached to rear of secondary spar inside the fuselage; nosewheel retracts into the front bulkhead, and is mounted by a lightweight carbon mount under the engine oil pan to aid engine protection in the event of a gear-up landing. Engine is removable while still on the landing gear. Access panels and wheel well covers are laid-up integrally, but still 90 per cent detached separate parts.

LANDING GEAR: Tricycle type; retractable. Oleo shock-absorbers on all units. Mainwheels retract by electric motor into aft section of cabin.



Algie LP-1 prototype under construction

1037953



Artist's impression of Algie LP-1

1195497

POWER PLANT: One 298 kW (400 hp) General Motors LS2 turbocharged V8 motorcar engine. Option of 395 kW (530 hp) LS7. All with 1.385:1 reduction gear. Fuel in wing tanks, total

235 litres (62.0 US gallons; 51.6 Imp gallons). Optional long-range tank under each wing, each 19 litres (5.0 US gallons; 4.2 Imp gallons).

ACCOMMODATION: Two persons in tandem. Accommodation pressurised.

DIMENSIONS, EXTERNAL:

Wing span	8.23 m (27 ft 0 in)
Wing aspect ratio	8.8
Length overall	6.40 m (21 ft 0 in)
Height overall	2.13 m (7 ft 0 in)
Tailplane span	3.05 m (10 ft 0 in)

DIMENSIONS, INTERNAL:

Cockpit max width	1.07 m (3 ft 6 in)
Baggage compartment:	
Length	0.97 m (3 ft 2 in)
Max width	0.56 m (1 ft 10 in)
Max height	0.38 m (1 ft 3 in)
Volume	0.21 m ³ (7.3 cu ft)

AREAS:

Wings, gross	7.66 m ² (82.5 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	490 kg (1,080 lb)
Max T-O weight	862 kg (1,902 lb)
Max wing loading	112.6 kg/m ² (23.05 lb/sq ft)
Max power loading (LS2)	2.89 kg/kW (4.76 lb/hp)

PERFORMANCE:

No estimates announced

AMD

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PRESIDENT: Mathieu Heintz

MANUFACTURING DIRECTOR: Shawn Fallin

SALES MANAGER: John Degonia

AMD was established in 1999 to produce and market the Zenair Zenith CH 2000 and CH2T. Its purpose-built, 2,600 m² (28,000 sq ft) factory became operational in December 1999; the first US-produced CH 2000 was completed in January 2000. In late 2003, partner Jordan Aerospace Industries (which see) began production of the SAMA CH 2000 derivative.

On 1 March 2001, AMD first flew the CH 640 kitbuilt, which draws on the CH 2000, but is now marketed by Zenair. In 2005, AMD began offering the LSA version of the CH 601XL.

AMD ZENITH CH 2000 ALARUS

TYPE: Two-seat lightplane.

PROGRAMME: Prototype C-FQCU first flown 26 June 1993; Canadian and US certification of prototypes 26 and 31 July 1994, respectively; first two production models (C-FRSK and C-FRSV) completed April 1994. First delivery September 1994; US type certification 25 July 1995 in Utility category and 29 January 2003 in Normal category. A test example fitted with 104.5 kW (140 hp) Lycoming O-320 was produced in 1995. Certified for IFR operations and spins on 2 October 1996. JAA certification received March 2000. Company revealed it would produce a lighter version during 2001, with 95 litre (25.0 US gallon; 20.8 Imp gallon) fuel capacity; this appears not to have occurred.

CURRENT VERSIONS: **CH 2000**: Standard production model, as described.

CH2T: Basic model intended for flight training market; avionics are not included.

SAMA CH2000: Produced by Jordan Aerospace Industries.

CUSTOMERS: Total of 43 delivered by time production moved from Canada to US in June 1999. First US-built aircraft (N17KA, one of 11 CH2Ts for KeyFlite Academy at Utica, New York, and Nashua, New Hampshire) received C of A on 14 January 2000 and delivered following day. Additionally, Zenair built production aircraft 0063 to 0065. A total of 134 built by September 2006.

COSTS: CH 2000 USD139,900 (2006). Provisional cost of lightweight version USD84,900 (2001).

DESIGN FEATURES: Side-by-side two-seat and smaller-span derivative of Tri-Z CH 300. Designed to conform to FAR Pt 23 (JAR-VLA equivalent level of safety). Conventional, low-wing configuration, with mid-mounted tailplane and sweptback fin.

Wing section LS (1) 0417 (mod).

FLYING CONTROLS: Manual. All-moving tailplane deflects 12° up and 9° 30' down with anti-balance tabs; all-moving fin/rudder with horn balance deflects 21° 30' each way. Electrically actuated split flaps lower to 50°; ailerons deflect ±15°.

STRUCTURE: Semi-monocoque fuselage of aluminium alloy, with stressed skins. Wings and tailplane aluminium skinned.

LANDING GEAR: Non-retractable tricycle type with steerable (±14°) nosewheel. Shock-cord absorption on nosewheel. Cleveland 5.00–5 in wheels with hydraulic disc brakes on mainwheels. Optional wheel fairings.

POWER PLANT: One 86.5 kW (116 hp) Textron Lycoming O-235-N2C, driving metal Sensenich 72-CK-0-46 or 72-CK-0-48 two-blade propeller. Fuel capacity 106 litres (28.0 US gallons; 23.3 Imp gallons) standard of which 104 litres (27.5 US gallons; 22.9 Imp gallons) are usable, 129 litres (34.0 US gallons; 28.3 Imp gallons) optional. Oil capacity 5.7 litres (1.5 US gallons; 1.25 Imp gallons).

SYSTEMS: 12 V 60 A, heavy-duty battery.

ACCOMMODATION: Two persons, side by side, with dual controls; upward-hinged door each side; fixed windscreens; rear side windows. AmSafe inflatable Restraint system certified for use in April 2004 and standard from 2006 onward. Baggage shelf behind seats.

AVIONICS: *Comms*: Based around Garmin GNS 430 COM/VOR/GPS, GI 106A CDI, GMA 340 audio panel and GTX 327 transponder, plus Bendix King KX155 NAV/COM. Options include PS 100II intercom.

DIMENSIONS, EXTERNAL:

Wing span	8.79 m (28 ft 10 in)
Wing aspect ratio	5.4
Length overall	7.01 m (23 ft 0 in)
Height overall	2.08 m (6 ft 10 in)
Propeller diameter	1.83 m (6 ft 0 in)

DIMENSIONS, INTERNAL:

Cabin max width	1.17 m (3 ft 10 in)
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AREAS:

Wings, gross	12.73 m ² (137.0 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	533 kg (1,085 lb)
Max baggage weight	18 kg (40 lb)
Max T-O weight: Utility	728 kg (1,606 lb)
Normal	767 kg (1,692 lb)
Max wing loading: Utility	57.2 kg/m ² (11.72 lb/sq ft)
Normal	60.3 kg/m ² (12.35 lb/sq ft)
Max power loading: Utility	8.43 kg/kW (13.84 lb/hp)
Normal	8.88 kg/kW (14.59 lb/hp)

PERFORMANCE:

Never-exceed speed (VNE)	139 kt (257 km/h; 160 mph)
Econ cruising speed	99 kt (183 km/h; 114 mph)
Stalling speed	48 kt (89 km/h; 55 mph)
Max rate of climb at S/L	229 m (750 ft)/min
Service ceiling	3,660 m (12,000 ft)
T-O to 15 m (50 ft)	500 m (1,640 ft)
Landing run	183 m (600 ft)
Landing from 15 m (50 ft)	555 m (1,820 ft)
Range with max payload: standard fuel	471 n miles (872 km; 542 miles)
optional fuel	851 n miles (1,577 km; 980 miles)
g limits, Utility category	+4.4/-2.2

AMD CH601XL

TYPE: Two-seat lightplane.

PROGRAMME: Introduced late 2005 as factory-manufactured version of popular CH 600/601 series of kitbuilt aircraft, meeting LSA criteria. Demonstrator N601NC (based on kitbuilt version) shown at AirVenture, Oshkosh, July 2005; first production SLISA was N601VA (built in Czech Republic); first US-built production aircraft was N601ZP (c/n 001S).

CURRENT VERSIONS: **AMD Zodiac CH601XL SLISA**: Baseline version; as described.

AMD Zodiac CH601XLI SLISA: IFR capable version, with heated pitot, full external lighting, dual electrical system and lightning protection, all based on that supplied for CH 2000 Alarus.

CUSTOMERS: Total 24 built by September 2006, including at least two CH601XLI versions. COSTS: CH601XL USD79,900; CH601XLI USD94,900 (2006).

DESIGN FEATURES: Conventional low-wing monoplane with all-moving vertical tail. Wing section NACA 23018 at root, NACA 23015 at tip; dihedral 6°; incidence 8°.



AMD Zenith CH 2000 Alarus (Paul Jackson)

1159753

For details of the latest updates to *Jane's All the World's Aircraft* online and to discover the additional information available exclusively to online subscribers please visit jawa.janes.com



Prototype of factory-built AMD Zenair CH601XL (Paul Jackson) 1159754



IFR-capable AMD Zenair CH601XLi (Paul Jackson) 1159755

FLYING CONTROLS: Manual. Long-span, 'piano hinged' ailerons; elevators; and Zenith all-moving vertical fin. Electric flaps.

STRUCTURE: All-aluminium monocoque.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted, spring aluminium cantilever mainwheel; 5.00-5 wheels and tyres throughout; hydraulic mainwheel brakes. Optional speed fairings on all three wheels.

POWER PLANT: One 74.6 kW (100 hp) Teledyne Continental O-200A flat-four driving two-blade Sensenich propeller. Fuel capacity 114 litres (30.0 US gallons; 25.0 Imp gallons) in two wing tanks.

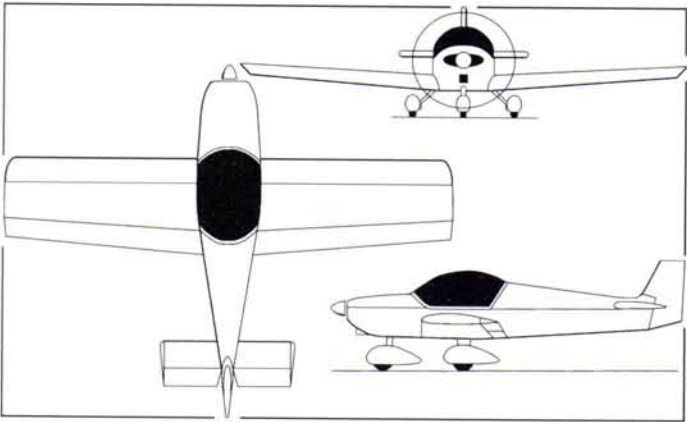
ACCOMMODATION: Two persons, side by side, with dual controls; tinted single-piece forward opening canopy.

SYSTEMS: Electrical system 12 V.

AVIONICS: Standard instrumentation includes ASI, altimeter, compass, engine monitoring system. IFR version adds full gyro panel; options include Garmin GPS MAP396 with WX satellite weather system; SL40 COM, SL30 NAV/COM, GNC 250 XL GPS/COM; GTX 327/330 transponder and GMA 340 audio panel.

Options include wing baggage lockers and airbag seatbelts.

EQUIPMENT: Options include wing baggage lockers and airbag seatbelts.



AMD Zenair CH601XL SLSA general arrangement 1041708

DIMENSIONS, EXTERNAL:	
Wing span	8.23 m (27 ft 0 in)
Wing chord: at main panel root	1.60 m (5 ft 3 in)
at tip	1.40 m (4 ft 7 in)
Wing aspect ratio	5.5
Length overall	6.10 m (20 ft 0 in)
Height overall	1.98 m (6 ft 6 in)
Tailplane span	2.31 m (7 ft 7 in)
Wheel track	2.13 m (7 ft 0 in)
Wheelbase	1.32 m (4 ft 4 in)
DIMENSIONS, INTERNAL:	
Cabin: max width	1.12 m (3 ft 8 in)
AREAS:	
Wings, gross	12.26 m ² (132.0 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	363 kg (800 lb)
Max T-O weight	598 kg (1,320 lb)
Max wing loading	48.8 kg/m ² (10.00 lb/sq ft)
Max power loading	8.03 kg/kW (13.20 lb/hp)
PERFORMANCE:	
Normal cruising speed	113 kt (209 km/h; 130 mph)
Stalling speed, power off: flaps up	46 kt (84 km/h; 52 mph)
flaps down	39 kt (71 km/h; 44 mph)
Max rate of climb at S/L	305 m (1,000 ft)/min
Service ceiling	3,658 m (12,000 ft)
Range	719 n miles (1,332 km; 828 miles)
Endurance	6 h 0 min
g limits	+6/-3.5

AMERICAN CHAMPION

AMERICAN CHAMPION AIRCRAFT CORPORATION
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PRESIDENT AND CEO: Jerry K Mehlhaff
GENERAL MANAGER: Dale Gauger
CHIEF ENGINEER: Jerry Mehlhaff Jr

ACAC offers new-build Citabria (now called Aurora, Adventure and Explorer), Super Decathlon and Scout, all designed by Aeronca, Model 7 (based on Second World War L-3 Grasshopper liaison/observation machine) certified 18 October 1945. Series later marketed by Champion Aircraft Corporation (1954); from 1970 by Bellanca Aircraft Corporation; and then, in 1982, Champion Aircraft Company. Assets transferred to Jerry Mehlhaff's American Champion Aircraft Corporation, which restarted production in 1990. By end of 2005, various

manufacturers had built 14,827 of the Model 7 and Model 8 families, American Champion being responsible for 840. In addition, ACAC offers its new metal spar wing for retrofit on all models, including the original 7AC Champion.

AMERICAN CHAMPION 7EC CHAMP

TYPE: Two-seat lightplane.

PROGRAMME: Original Aeronca Model 7 and successors built in 16 subvariants, with various letter suffixes. Model 7AC Champion was initial production version, certified 18 October 1945 with 48.5 kW (65 hp) Continental A65 flat-four (7,200 built) from 1945 onwards. Model 7ACA Champ certified 30 April 1971 with 44.7 kW (60 hp) Franklin engine, but only 71 built by Bellanca.

American Champion proposed relaunch as 7ACA Champ with 59.7 kW (80 hV) Jabiru 2200 flat-four; new-build prototype (N82AC) displayed at EAA AirVenture Oshkosh in July 2000, shortly after first flight. This variant did not enter production; succeeded by 7EC Champ with Teledyne Continental O-200 engine, available from 2006, with three (N349AC, N707WM and N69SG, c/ns 101 to 103 respectively), registered in first half of that year. Designation duplicates 7EC Traveler version certified 30 November 1949 with 67.1 kW (90 hp) Continental C90 (773 built).

AMERICAN CHAMPION PRODUCTION
(at 1 January 2006)

Version	Certification	Number Built	Number built ¹	Recent Shipments					ACA Total
		To 1989	To end-05	2001	2002	2003	2004	2005	
7AC	18 Oct 45	7,200	7,201						1
7ACA	30 Apr 71	71	71						
7BCM	16 Sep 47	509	509						
7CCM	12 Jul 48	226	226						
7DC	12 Jul 48	184	184						
7EC	30 Nov 49	773	773						
7ECA	5 Aug 64	1,353	1,395	2	3	2	2	3	42
7GC	30 Oct 58	171	171						
7GCA/AA	17 Nov 59	396	501	8	12	9	12	12	105
7GCB/BA	28 Apr 60	195	195						
7GBCB	3 Dec 65	1,215	1,422 ²	21	13	12	24	26	207
7HC	6 Aug 59	39	39						
7JC	24 Feb 60	25	25						
7KC	10 Jan 61	4	4						
7KCAB	21 Dec 66	624	624						
8GBCB	30 Apr 74	360	475	6	11	8	18	9	115
8KCAB	16 Oct 70	642	1,012	19	14	32	38	39	370
Totals		13,987	14,827	56	53	63	94	89	840

¹ Shipment totals differ slightly from annual production totals
² Including 16 aircraft duplicating previous Bellanca c/ns



First production American Champion 7EC Champ making its public debut at AirVenture, Oshkosh, July 2006 (R W Simpson)

1162401

COSTS: USD84,900 (2006).

DESIGN FEATURES: High-wing cabin monoplane; wings braced by V-struts and two secondary struts each side; wire-braced fin and tailplane; constant-chord wings; all flying surfaces have rounded tips.

FLYING CONTROLS: Conventional and manual. Horn-balanced elevators and rudder. No flaps. STRUCTURE: Welded Chromoly steel tube fuselage and tail surfaces; two-spar wing has aluminium spars and ribs, Dacron covering.

LANDING GEAR: Tailwheel type; fixed. Fuselage-mounted spring steel cantilever main legs. POWER PLANT: One 74.6 kW (100 hp) Teledyne Continental O-200-A flat-four driving a Sensenich W72GK-44U two-blade fixed-pitch wooden propeller. Fuel capacity 68 litres (18 US gallons; 17.5 US gallons), of which 66 litres (17.5 US gallons; 1mp gallons) usable. Oil capacity 5.7 litres (1.5 US gallons; 1.3 Imp gallons).

ACCOMMODATION: Pilot and passenger in tandem. Door on starboard side, opening centre window on port side.

DIMENSIONS, EXTERNAL:

Wing span	10.21 m (33 ft 6 in)
Wing aspect ratio	6.8
Length overall	6.74 m (22 ft 1 1/4 in)
Height overall	2.35 m (7 ft 8 1/2 in)
Propeller diameter	1.83 m (6 ft 0 in)

DIMENSIONS, INTERNAL:

Cabin:	
Length	2.69 m (8 ft 10 in)
Max width	0.76 m (2 ft 6 in)
Max height	1.19 m (3 ft 11 in)

AREAS:

Wings, gross	15.33 m ² (165.0 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	417 kg (920 lb)
Max T-O weight	598 kg (1,320 lb)
Payload with max fuel	132 kg (292 lb)
Max baggage	45 kg (100 lb)
Max wing loading	39.06 kg/m ² (8.00 lb/sq ft)
Max power loading	8.03 kg/kW (13.20 lb/hp)

PERFORMANCE:

g limits	+5/-2
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AMERICAN CHAMPION 7ECA CITABRIA AURORA

TYPE: Two-seat lightplane.

PROGRAMME: Currently the lowest powered of the American Champion range, the 7EC was certified on 30 November 1949 and 7ECA on 5 August 1964; 773 of former and 1,369 of latter had been built up to 1984; was reintroduced into range during 1995 as the cheapest aircraft. Current production aircraft has improved ventilation and heating; redesigned instrument panel and quick-jettison door; and dual controls and brakes.

CUSTOMERS: Total 1,395 produced by late 2005. One delivered in the first six months of 2006.

COSTS: Standard aircraft USD90,900 (2006).

DESIGN FEATURES: High-wing cabin monoplane; wings braced by V-struts and two secondary struts each side; wire-braced fin and tailplane; constant-chord wings; sweptback fin with (current versions) squared tip.

Wing section NACA 4412; dihedral 1°.

FLYING CONTROLS: Conventional and manual. Horn-balanced elevators and rudder. Flight-adjustable trim tab in port elevator. No flaps. Control surface movements: ailerons +27°/-30°/-19°; elevators ±24°; rudder ±25°. Aileron suspended balance tabs (spades) optional.

STRUCTURE: Stainless steel exhaust system. Fuselage and empennage are welded chromoly steel tube with Dacron covering; two-spar wing has aluminium spars and ribs, Dacron covering, GFRP tips and steel tube V struts.

LANDING GEAR: Tailwheel type; fixed. Fuselage-mounted, cantilever spring steel mainwheel legs; mainwheels 6.00-6 (4 ply); tailwheel 5.00, steerable. Hydraulic, toe-operated disc and parking brakes. Main wheel fairings optional. Floatplane option includes auxiliary fins above and below tailplane.

POWER PLANT: One 88 kW (118 hp) Textron Lycoming O-235-K2C flat-four piston engine driving a Sensenich 72 CKS8-0 fixed-pitch propeller. Fuel in two wing tanks, total capacity 136 litres (36.0 US gallons; 30.0 Imp gallons) of which 132 litres (35.0 US gallons;

29.1 Imp gallons) usable; overwing refuelling point for each tank. Oil capacity 5.7 litres (1.5 US gallons; 1.3 Imp gallons). Stainless steel exhaust system standard.

ACCOMMODATION: Pilot and passenger in tandem on foam-filled seats with folding backrests; five-point safety harness; quick jettison door on starboard side; pilot's port window hinged upwards and outwards. Space for baggage behind seats. Dual controls. Options include split door for photographic work, external bottom-hinged baggage door, greenhouse roof and tinted cabin windows, wide rear seat and rear seat heater.

SYSTEMS: Electric starter; 60 A alternator; 12 V gel-cell battery; voltage regulator with protector. Optional lighting system.

AVIONICS: To customer's choice.

Comms: Optional Communication Group includes Garmin GNC 250XL com/nav, GTX 327 transponder, broadband transmitting antenna, twin headset jacks, cabin speaker and noise cancelling microphone, Intercom system, front and rear PIT switches and ELT also optional.

Flight: Full vacuum gyro package and electric attitude indicator and directional gyro set optional.

Instrumentation: ASI, sensitive altimeter, magnetic compass, dual fuel gauges, lighted magnetic compass, oil temperature and pressure gauges and recording tachometer all standard. VSI, electric turn co-ordinator, OAT gauge, EGT gauge, CHT gauge, combination EGT/CHT eight-probe scanner, engine hours meter with oil pressure switch, and bullet spinner. Options include aileron spades, mainwheel fairings, split photo door, wide rear seat, rear seat heater, deluxe Duraplus interior fabrics, aluminium main landing gear legs, landing gear leg steps, speed kit including upper and lower wing strut fairings, CFP-2 corrosion protection, remote mounted Air-Wolf oil filter and oil quick drain and electric clock optional.

EQUIPMENT: Standard equipment includes navigation lights, landing light, cabin light, dual wingtip strobe lights, deluxe textured vinyl interior.

DIMENSIONS, EXTERNAL:

Wing span	10.21 m (33 ft 6 in)
Wing aspect ratio	6.8
Length overall	6.73 m (22 ft 1 in)
Height overall	2.35 m (7 ft 8 1/2 in)
Propeller diameter	1.83 m (6 ft 0 in)

DIMENSIONS, INTERNAL:

Cabin: Length	2.69 m (8 ft 10 in)
Max width	0.76 m (2 ft 6 in)
Max height	1.19 m (3 ft 11 in)

AREAS:

Wings, gross	15.33 m ² (165.0 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty, equipped	508 kg (1,120 lb)
Max baggage weight	45 kg (100 lb)
Max T-O weight	793 kg (1,750 lb)
Payload with max fuel	191 kg (420 lb)
Max wing loading	51.8 kg/m ² (10.61 lb/sq ft)
Max power loading	9.03 kg/kW (14.83 lb/hp)

PERFORMANCE:

Never-exceed speed (VNE)	140 kt (260 km/h; 162 mph)
Max level speed at S/L	104 kt (193 km/h; 120 mph)
Cruising speed at 75% power	100 kt (185 km/h; 115 mph)
Stalling speed	46 kt (84 km/h; 52 mph)
Max rate of climb at S/L	226 m (740 ft)/min
Service ceiling	3,810 m (12,500 ft)
T-O run	198 m (650 ft)
T-O to 15 m (50 ft)	320 m (1,050 ft)
Landing from 15 m (50 ft)	270 m (885 ft)
Landing run	159 m (520 ft)

Range with max fuel, allowance for start, taxi, S/L, T-O, climb and descent, no reserves:

at 75% power	556 n miles (1,030 km; 640 miles)
at 55% power	617 n miles (1,142 km; 710 miles)

Endurance 5 h 6 min

g limits +5/-2

AMERICAN CHAMPION 7GCAA CITABRIA ADVENTURE

TYPE: Two-seat lightplane.

PROGRAMME: American Champion 7GCAA Adventure relaunched 1997. Model 7GCA originally certified 17 November 1959 and 7GCAA 30 July 1965; these built up to 1980.

CUSTOMERS: Total 505 built by June 2006, including 396 in first series.

COSTS: USD104,900 (2006).

DESIGN FEATURES: As for Aurora.

FLYING CONTROLS: As for Aurora except elevator movements +28°/-24°.

STRUCTURE: As for Aurora.

LANDING GEAR: As for Aurora.

POWER PLANT: One 119 kW (160 hp) Textron Lycoming O-320-B2B flat-four engine driving a two-blade fixed-pitch Sensenich 74DM6S8-1-56 propeller. Fuel capacity as for Aurora, oil capacity 7.6 litres (2.0 US gallons; 1.67 Imp gallons).

ACCOMMODATION: As for Aurora.

SYSTEMS: As for Aurora.

AVIONICS: As for Aurora.

EQUIPMENT: As for Aurora.



American Champion 7GCAA Citabria Adventure (Paul Jackson)

1158207



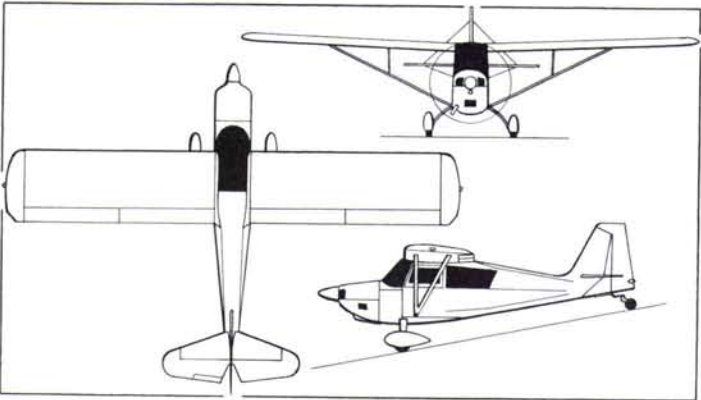
American Champion 7ECA Citabria Aurora (Paul Jackson)

1158199

DIMENSIONS, EXTERNAL: As for Aurora, except:	
Propeller diameter	1.85 m (6 ft 1 in)
DIMENSIONS, INTERNAL: As for Aurora	
AREAS: As for Aurora	
WEIGHTS AND LOADINGS: As for Aurora, except:	
Weight empty	544 kg (1,200 lb)
Payload with max fuel	154 kg (340 lb)
Max power loading	6.66 kg/kW (10.94 lb/hp)
PERFORMANCE:	
Never-exceed speed (VNE)	140 kt (260 km/h; 162 mph)
Max level speed	121 kt (225 km/h; 140 mph)
Max cruising speed at 75% power	117 kt (217 km/h; 135 mph)
Stalling speed, power off	46 kt (84 km/h; 52 mph)
Max rate of climb at S/L	356 m (1,167 ft)/min
Service ceiling	5,029 m (16,500 ft)
T-O run	131 m (430 ft)
T-O to 15 m (50 ft)	273 m (895 ft)
Landing from 15 m (50 ft)	259 m (850 ft)
Landing run	146 m (480 ft)
Range with max fuel:	
at 75% power, no reserves	482 n miles (893 km; 555 miles)
at 55% power	595 n miles (1,102 km; 685 miles)
Endurance	3 h 6 min
g limits	+5/-2

AMERICAN CHAMPION 7GCBC CITABRIA EXPLORER

TYPE: Two-seat lightplane.	
PROGRAMME: Formerly Citabria 150S, certified 3 December 1965.	
CURRENT VERSIONS: Explorer: As described.	
High Country Explorer: Announced July 2004; powered by Superior Air Parts Inc Vantage O-360-A3A2 flat-four, unleaded fuel piston engine, derated to 134 kW (180 hp) and delivering 108 kW (145 hp) at 2,285 m (7,500 ft), compared with 87 kW (117 hp) of standard 7GCBA power plant, driving a Sensenich 76EM8S8-0-58 fixed-pitch propeller, diameter 1.93 m (6 ft 4 in). Other features include Micro Aerodynamics vortex generators aluminium main landing gear with 800 × 6 tyres, heavy duty Lord engine mounts, cowl flap, and upgraded exhaust system. Prototype flown mid-2004; demonstrated 549 m (1,800 ft)/min climb at S/L.	
CUSTOMERS: Total of 1,431 built by June 2006.	
COSTS: Standard aircraft USD108,900; with High Country package USD115,900 (both 2006).	
DESIGN FEATURES: As for Aurora. Specific 7GCBC features include optional wheel fairings, NACA 4412 aerofoil section. Dihedral 2°; incidence 1°.	
FLYING CONTROLS: As for Aurora, except elevator movements +28/-24°. Flaps; maximum deflection 35°.	
STRUCTURE: Aluminium alloy (front) and steel tube (aft) bracing struts.	
LANDING GEAR: As for Aurora.	
POWER PLANT: As for Adventure. Fuel and oil as for Aurora.	
ACCOMMODATION: As for Aurora.	
SYSTEMS: As for Aurora.	
AVIONICS: As for Aurora. Optional IFR package comprises heated pitot head, Bendix/King KR 22 marker beacon receiver, panel lighting and gyro backlighting upgrade.	
EQUIPMENT: As for Aurora.	
DIMENSIONS, EXTERNAL:	
Wing span	10.49 m (34 ft 5 in)
Wing chord, constant	1.52 m (5 ft 0 in)
Wing aspect ratio	6.9
Length overall	6.74 m (22 ft 1 in)
Height overall	2.35 m (7 ft 8½ in)
Wheel track	1.93 m (6 ft 4 in)
Wheelbase	4.90 m (16 ft 1 in)
Propeller diameter	1.85 m (6 ft 1 in)
DIMENSIONS, INTERNAL: As for Aurora	
AREAS:	
Wings, gross	15.97 m ² (171.9 sq ft)
Ailerons (total)	1.53 m ² (16.50 sq ft)
Fin	0.65 m ² (7.02 sq ft)
Rudder	0.63 m ² (6.83 sq ft)
Tailplane	1.14 m ² (12.25 sq ft)
Elevators (total, incl tab)	1.35 m ² (14.58 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty, equipped	567 kg (1,250 lb)
Baggage capacity	45 kg (100 lb)
Max T-O and landing weight	816 kg (1,800 lb)



General arrangement of the American Champion 7GCBC Citabria Explorer (James Goulding) 1158208

Max wing loading	51.1 kg/m ² (10.47 lb/sq ft)
Max power loading	6.85 kg/kW (11.25 lb/hp)
PERFORMANCE:	
Never-exceed speed (VNE)	140 kt (261 km/h; 162 mph)
Max level speed at S/L	115 kt (212 km/h; 132 mph)
Cruising speed:	
at 75% power, at optimum height	111 kt (206 km/h; 128 mph)
at 65% power	107 kt (198 km/h; 123 mph)
Stalling speed, flaps up	45 kt (82 km/h; 51 mph)
flaps down	40 kt (74 km/h; 46 mph)
Max rate of climb at S/L	344 m (1,130 ft)/min
Service ceiling	5,182 m (17,000 ft)
T-O run	126 m (412 ft)
T-O to 15 m (50 ft)	200 m (656 ft)
Landing from 15 m (50 ft)	226 m (740 ft)
Landing run	110 m (360 ft)
Range with max fuel, allowance for start, taxi, S/L, T-O, climb and descent, no reserves:	
at 75% power	431 n miles (799 km; 496 miles)
at 55% power	521 n miles (966 km; 600 miles)
g limits	+5/-2

AMERICAN CHAMPION 8GCBC SCOUT

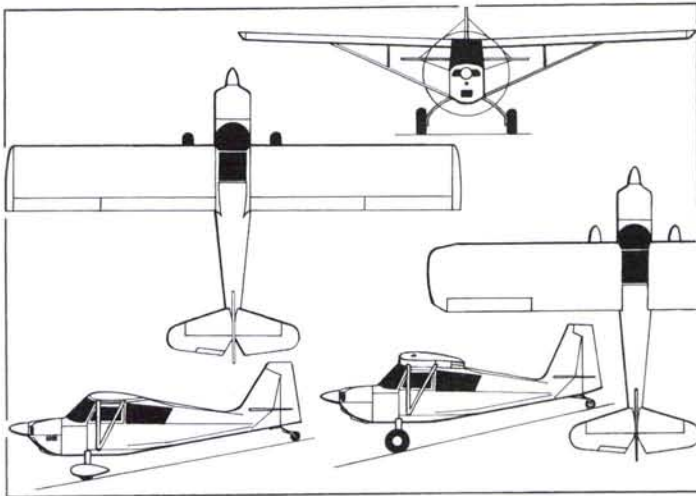
TYPE: Two-seat lightplane.	
PROGRAMME: Model 8 series of Champion developed by Bellanca as heavy-duty version of Model 7; second subvariant was 8GCBC, which received type approval on 30 April 1974.	
CUSTOMERS: Total of 478 built by mid-2006 including four in the first six months of 2006. Customers include the Department of Conservation and Land Management of Western Australia, which operates eight Scouts on fire spotting duties, replacing Piper Super Cubs.	
COSTS: Two-blade constant-speed propeller USD129,900; three-blade constant-speed propeller USD134,000.	
DESIGN FEATURES: Upgraded version of Bellanca/Champion Scout, with new lighter and stronger metal spar wing with 300 per cent less deflection than previous wooden wings; circuit breakers; modern avionics; revised interior; and high-gloss weather-resistant exterior finish. Can operate from short fields while towing glider or banner; low speed assists pipeline, border patrol, forestry and wildlife management roles.	
Wing section NACA 4412; dihedral 1°; incidence 1°.	
FLYING CONTROLS: As for Explorer. Control surface movements: ailerons +27° 30/-19°; elevators +29/-26°; rudder ±25°. Four-position trailing-edge flaps droop 7, 16, 21 and 27°.	
STRUCTURE: As for Explorer, but metal belly skin optional.	
LANDING GEAR: As for Aurora; main tyres 8.50-6 (4/6 ply); tail 5.00-5 (4 ply). Optional EDO 89-2000 floats or amphibious floats, or skis.	
POWER PLANT: One 134 kW (180 hp) Textron Lycoming O-360-C1G flat-four engine, driving a McCauley 1A200HFA80 fixed-pitch (Scout) or Hartzell HC-C2YR-1BF/FC7666A constant-speed propeller (Super Scout); three-blade 1.83 m (6 ft 0 in) Hartzell HC-C3YR-1RF/F7282 constant-speed propeller optional. Standard fuel capacity as for Aurora; optional additional tank increases usable total to 265 litres (70.0 US gallons; 58.3 Imp gallons). Oil capacity 7.5 litres (2.0 US gallons; 1.7 Imp gallons).	
ACCOMMODATION: As for Aurora. Heated and ventilated.	
SYSTEMS: As for Aurora.	
AVIONICS: As for Aurora.	



High Country version of American Champion 7GCBC Citabria Explorer (Paul Jackson) 1127943



American Champion 8GCBC Scout in seaplane configuration (Paul Jackson) 1162408



American Champion 8KCAB general arrangement, with scrap plan view and additional side view (left) of 8KCAB (James Goulding) 1158201

EQUIPMENT: External baggage door standard. Options include cropduster package, long-range fuel tank and glider tow assembly.

DIMENSIONS, EXTERNAL (A: Scout; B: Super Scout):

Wing span	11.02 m (36 ft 2 in)
Wing chord, constant	1.52 m (5 ft 0 in)
Wing aspect ratio	7.3
Length overall: A	6.95 m (22 ft 9½ in)
B	7.01 m (23 ft 0 in)
Height overall: A	2.65 m (8 ft 8½ in)
B	2.96 m (9 ft 8½ in)
Tailplane span	3.10 m (10 ft 2¼ in)
Propeller diameter: Hartzell	1.93 m (6 ft 4 in)
McCaughey	2.03 m (6 ft 8 in)

DIMENSIONS, INTERNAL: As for Aurora

AREAS:

Wings, gross	16.70 m ² (180.0 sq ft)
Ailerons (total)	1.57 m ² (16.88 sq ft)
Flaps (total)	2.25 m ² (24.26 sq ft)

WEIGHTS AND LOADINGS (A and B as above):

Weight empty: A	596 kg (1,315 lb)
B	635 kg (1,400 lb)
Baggage capacity	45 kg (100 lb)
Max T-O weight: Normal, A, B	975 kg (2,150 lb)
Restricted: A	1,179 kg (2,600 lb)
Max wing loading:	
Normal: A, B	58.3 kg/m ² (11.94 lb/sq ft)
Restricted: A	70.5 kg/m ² (14.44 lb/sq ft)
Max power loading:	
Normal: A, B	7.28 kg/kW (11.94 lb/hp)
Restricted: A	8.80 kg/kW (14.44 lb/hp)

PERFORMANCE:

Never-exceed speed (VNE): A, B	140 kt (260 km/h; 162 mph)
Max level speed at S/L: A	117 kt (217 km/h; 135 mph)
B	125 kt (232 km/h; 144 mph)
Cruising speed at 75% power: A	106 kt (196 km/h; 122 mph)
B	116 kt (216 km/h; 134 mph)
Stalling speed, flaps up: A	47 kt (87 km/h; 54 mph)
flaps down: A	44 kt (81 km/h; 50 mph)
flaps down: B	43 kt (79 km/h; 49 mph)
Max rate of climb at S/L: A	329 m (1,080 ft)/min
B	381 m (1,250 ft)/min
Service ceiling: A	4,572 m (15,000 ft)
B	5,334 m (17,500 ft)
T-O run: A	125 m (410 ft)
B	119 m (390 ft)
Range: at 75% power; standard fuel: A	333 n miles (618 km; 384 miles)
B	360 n miles (667 km; 415 miles)
optional fuel: A	680 n miles (1,260 km; 783 miles)
B	731 n miles (1,355 km; 842 miles)

at 55% power, optional fuel: A	779 n miles (1,443 km; 897 miles)
B	837 n miles (1,551 km; 964 miles)

AMERICAN CHAMPION 8KCAB SUPER DECATHLON

TYPE: Two-seat lightplane.

PROGRAMME: Original Decathlon was powered by a 112 kW (150 hp) Lycoming IO-320 or AEIO-320; certified 16 October 1970 in Normal and Aerobatic categories. Super introduced by American Champion; first flight (N38AC) July 1990. The Fixed-Pitch Decathlon (Sensenich propeller) is no longer marketed.

CUSTOMERS: Total of 1,020 delivered by mid-2006, including 13 in the first six months of 2006.

COSTS: Standard price USD137,900 (2006).

DESIGN FEATURES: Generally as for Aurora. Cleared for limited inverted flight; constant-speed propeller. Wing section NACA 1412 (modified); dihedral 1°; incidence 1° 30'.

FLYING CONTROLS: As for Aurora, but with balanced elevators. Control surface movements: ailerons ±30°; elevators ±20°; rudder ±30°.

STRUCTURE: As for Aurora. Optional metal wing spar.

LANDING GEAR: As for Aurora. Mainwheel tyres 6.00-6 or 8.00-6 (4 ply), tail tyre 5.00-5 (4 ply). Cleveland disc brakes; optional wheel fairings.

POWER PLANT: One 134 kW (180 hp) Textron Lycoming AEIO-360-H1B flat-four engine, driving a Hartzell HC C2YR 4CF/FC7666A-2 two-blade constant-speed propeller. Fuel capacity 151 litres (40.0 US gallons; 33.3 Imp gallons), of which 148 litres (39.0 US gallons; 32.5 Imp gallons) are usable. Oil capacity 9.5 litres (2.5 US gallons; 2.1 Imp gallons).

ACCOMMODATION: As for Aurora, but competition Hooker harness optional.

SYSTEMS: As for Aurora, plus accelerometer and electric fuel boost pump.

AVIONICS: As for Aurora.

DIMENSIONS, EXTERNAL:

Wing span	9.75 m (32 ft 0 in)
Wing chord, constant	1.63 m (5 ft 4 in)
Wing aspect ratio	6.1
Length overall	6.98 m (22 ft 10¾ in)
Height overall	2.36 m (7 ft 9 in)
Tailplane span	3.10 m (10 ft 2¼ in)
Propeller diameter	1.88 m (6 ft 2 in)

DIMENSIONS, INTERNAL: As for Aurora

AREAS:

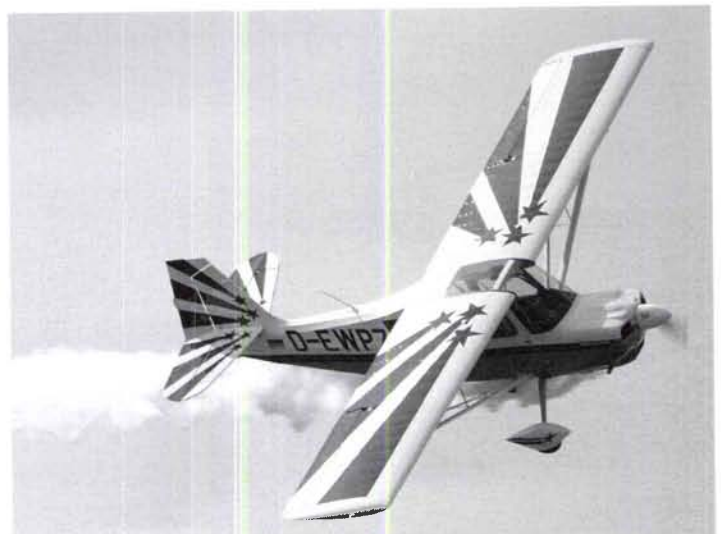
Wings, gross	15.71 m ² (169.1 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	608 kg (1,340 lb)
Baggage capacity	45 kg (100 lb)
Max T-O weight	816 kg (1,800 lb)
Payload with max fuel	103 kg (226 lb)
Max wing loading	52.0 kg/m ² (10.64 lb/sq ft)
Max power loading	6.09 kg/kW (10.00 lb/hp)

PERFORMANCE:

Never-exceed speed	173 kt (321 km/h; 200 mph)
Max level speed at FL70	135 kt (249 km/h; 155 mph)
Cruising speed:	
at 75% power	128 kt (237 km/h; 147 mph)
at 55% power	111 kt (206 km/h; 128 mph)
Stalling speed, clean	46 kt (86 km/h; 53 mph)
Max rate of climb at S/L	390 m (1,280 ft)/min
Service ceiling	5,182 m (17,000 ft)
T-O run	120 m (395 ft)
T-O to 15 m (50 ft)	276 m (904 ft)
Landing from 15 m (50 ft)	321 m (1,051 ft)
Landing run	130 m (425 ft)
Range, no reserves:	
at 75% power	509 n miles (944 km; 587 miles)
at 55% power	542 n miles (1,006 km; 625 miles)
Endurance: at 75% power	3 h 24 min
at 55% power	4 h 24 min
g limits	+6/-5



Aerobatic performance by American Champion 8KCAB Super Decathlon (Paul Jackson) 1158209

AMERICAN LEGEND

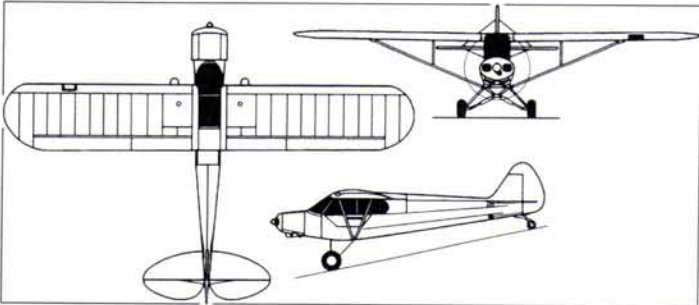
AMERICAN LEGEND AIRCRAFT COMPANY

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Web: www.legendaircraftcompany.com
PRESIDENT: Tim Elliott
VICE-PRESIDENT: Darin Heart
VICE-PRESIDENT, MANUFACTURING: Bryan Hurley

Legend was established in September 2004 to produce a version of Piper Cub in the US LSA category. Further variants with alternative engine and equipment standards were launched in 2006.

AMERICAN LEGEND CUB

TYPE: Two-seat lightplane.
PROGRAMME: Taylor J2 Cub became Piper J3 Cub in 1937 and built for USAAF in Second World War as L-4 Grasshopper. Several post-war variants, including PA-11 Cub Special, with fully enclosed engine. This eventually replaced by PA-18 Super Cub (which latter continues to be built by Cub Crafters).
American Legend is one of several companies offering reproductions of early Cub versions. First Legend aircraft (N23787) completed February 2005 in J3 guise; second (N23838) as demonstrator for PA-11 equivalent; this shown at AirVenture, Oshkosh, in July 2005, together with initial production aircraft (N77335), another J3, LSA category approval awarded 21 July 2005.
CURRENT VERSIONS: **AL3C-100 Legend Cub:** J3 equivalent; exposed engine cylinders; Continental engine.
AL11C-100 Legend Cub: PA-11 equivalent (although without this variant's fully divided landing gear); full cowling for Continental engine.
AL11C-100 Legend Cub Special: Announced 3 April 2006 with extra features as standard, including leather interior, adjustable air vents, interior light, landing light, composites propeller, strobe navigation lights, and nav/com package of Garmin SL 40 radio, GTX 327 transponder, GPS Map 396, with option of 188 mm (7 in) Dynon FlightDEK-D180 EFIS.
AL11J-120 Legend Cub Special: Prototype Cub Special (N82LC) exhibited at Sun 'n' Fun, Lakeland, Florida, April 2006, with Jabiru 3300 engine, which intended as optional power plant from mid-2006.



American Legend AL11C Cub two-seat lightplane (Paul Jackson) 1129164



Prototype AL11J-120 Legend Cub Special powered by Jabiru engine (Paul Jackson) 1037966

FloatCub: Floatplane; Continental engine. Weight empty 451 kg (995 lb); max level speed 80 kt (148 km/h; 92 mph); cruising speed 71 kt (132 km/h; 82 mph) at 75 per cent power; range 204 n miles (378 km; 235 miles).
CUSTOMERS: More than 30 ordered by July 2005, all of which had been registered by April 2006.
Piper built 20,290 J3/L-4s between 1938 and 1947 (not including 695 Taylor J2s); further 1,541 PA-11s followed. Original designation in doubt; Type Certificates (ATC 660 and A-691) (retained by New Piper) quote both J3 and J-3, but most aircraft registered as J3s, including all but 254 of 4,687 on the US register in 2005. Further 89 J2s and 545 PA-11s also remain in US.
COSTS: Cub USD74,000 flyaway (2005); Cub Special USD105,000 (2006).
DESIGN FEATURES: High wing braced by streamlined V-struts and auxiliary struts; rounded fin and tailplane mutually wire-braced. Option of traditional (rounded) or Hoerner wingtips. Legend Cub is optimised for US LSA category.
FLYING CONTROLS: Conventional and manual. Variable incidence tailplane. No flaps. Control actuation by cables.
STRUCTURE: Welded steel tube fuselage; metal wing structure; both fabric-covered, except metal engine cowling.
LANDING GEAR: Tailwheel type; fixed. Two faired-in side Vs hinged to lower longerons, with helical spring-damped half-axes attached to compression frame; hydraulic brakes. Mainwheels 8.00-6; steerable, solid tailwheel. Float attachments standard; optional Baumann floats.
POWER PLANT: One 74.6 kW (100 hp) Teledyne Continental O-200 flat-four driving a Sensenich two-blade, metal, fixed-pitch propeller. Optionally, from mid-2006, 89 kW (120 hp) Jabiru 3300 flat-six. Fuel capacity 83 litres (22.0 US gallons; 18.3 Imp gallons) of which 76 litres (20.0 US gallons; 16.7 Imp gallons) usable.
ACCOMMODATION: Two persons in tandem, with horizontally divided doors each side, upward/downward-hinged. Cockpit 8 cm (3 in) wider than original Cub.
DIMENSIONS, EXTERNAL:

Wing span	10.82 m (35 ft 6 in)
Wing chord, constant	1.60 m (5 ft 3 in)
Wing aspect ratio	7.1
Length overall: except FloatCub	6.83 m (22 ft 5 in)
FloatCub	7.29 m (23 ft 11 in)
Height overall: FloatCub	2.76 m (9 ft 0¾ in)
propeller turning: Cub	2.43 m (7 ft 11¾ in)
Cub Special	2.29 m (7 ft 6 in)
Tailplane span	2.88 m (9 ft 5½ in)
AREAS:	
Wings, gross	16.58 m² (178.5 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	386 kg (850 lb)
Max T-O weight	598 kg (1,320 lb)
Max power loading	8.03 kg/kW (13.20 lb/hp)
PERFORMANCE (AL3C-100):	
Max level speed	87 kt (161 km/h; 100 mph)
Cruising speed at 75% power	83 kt (153 km/h; 95 mph)
Stalling speed	33 kt (62 km/h; 38 mph)
Max rate of climb at S/L	213 m (700 ft)/min
Service ceiling	4,570 m (15,000 ft)
T-O run	64 m (210 ft)
Landing run	62 m (205 ft)
Range with max payload	234 n miles (434 km; 270 miles)

AMV

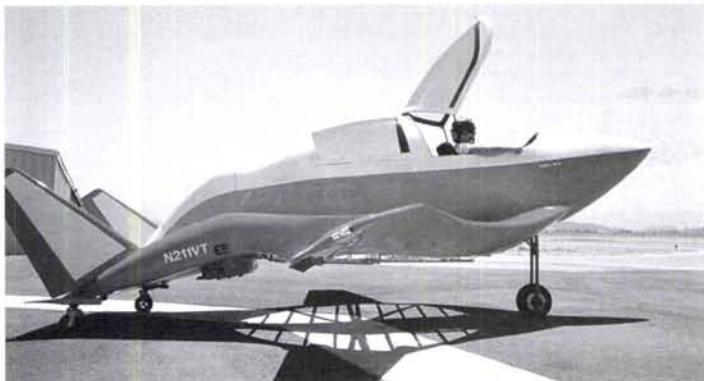
AMV AIRCRAFT

18 Via Tranquila, Aliso Vieho, California 92656-6214
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Web: www.AMVaircraft.com
OWNER: Attila Melkuti

Mr Melkuti plans to fly an aircraft he describes as the world's first practical flying machine to have a single ducted propeller and be capable of short or vertical take-off and landing. Flight test attempts began in January 2006 but were curtailed by engine failure.

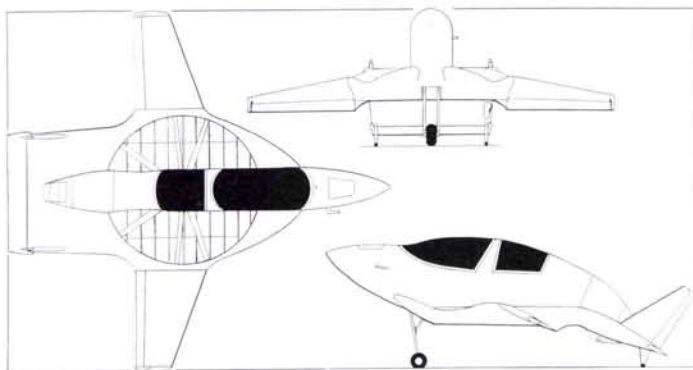
AMV 211

TYPE: Technology demonstrator.
PROGRAMME: Prototype completed in July 2003 shown statically at AirVenture, Oshkosh, later same month, following which preparations were to be made for flight. Registration N211VT reserved in 1999, but only activated in September 2003. Aircraft completed in October 2003; after initial ground tests, engine cooling was improved to prevent over-heating during hovering and modification were effected to the roll control system. Experimental category airworthiness certificate awarded July 2004; maiden flight was attempted in January 2006 but was thwarted by total engine failure when 15 cm (6 in) above the ground. Programme then suspended to allow installation of a more powerful turboshaft engine, increased fuel



AMV 211 ready for flight testing

1121789



AMV 211 technology demonstrator (Paul Jackson)

0580858

capacity and improved stability control for vertical flight. These changes not expected to change empty weight.

CURRENT VERSIONS: **Prototype:** As described.

Production: Slightly enlarged version with tandem seats; turboshaft engine in 447 to 597 kW (600 to 800 shp) class.

Six-seat: Certified, six-seat business aircraft with two turboshafts, each 597 to 671 kW (800 to 900 shp).

DESIGN FEATURES: Duct for eight movable louvres and horizontally mounted, five-blade propeller below fuselage, with wings outboard. Twin fins on tailbooms, each with rudder. Beaver tail with full-width elevator, including anti-balance tab.

For vertical take-off, louvres are vertical; after rising, craft tilted forward by inclination of louvres to deflect thrust, gradually gathering forward speed. When thrust plane reaches some 26° inclination, wing is horizontal, creating lift.

Wings NACA 65,-215 at root; 64,-112 at tip; no dihedral; incidence 1°; no twist.

FLYING CONTROLS: Full-span ailerons, elevator, and rudders balanced by weight (horn type). No flaps, but control louvers placed in the propeller slipstream for control during vertical flight and transition to horizontal flight. Rudders controlled by cables, elevator and ailerons by pushrods and bell cranks. Elevator equipped with electrically actuated trim tab. Control louvre, which controls pitch during hover, is mechanically connected to elevator roll controls for hover are mechanically connected to the ailerons. Torque (yaw) control during hover is achieved by two louvres moving in opposite directions these are located centrally in the propeller's slipstream, and are electrically actuated.

STRUCTURE: Load-bearing structure is welded, chromoly tubing. Fuselage wings, and other aerodynamic surfaces are moulded graphite epoxy composites. Propeller blades are graphite and Kevlar.

LANDING GEAR: Tricycle type; semi-retractable. Monowheel and twin, fixed tailwheels one beneath each fin. Monowheel hydraulically turned some 40 degrees rearwards for horizontal flight. Disk brakes on mainwheel.

POWER PLANT: One 336 kW (450 hp) Mazda turbocharged rotary engine initially fitted to prototype, but proved insufficiently powerful. Replacement by Textron Lycoming T53 turboshaft (of unspecified rating) under way in 2006. Fuel capacity originally 189 litres (50.0 US gallons; 41.6 Imp gallons) in four wing and fuselage tanks, but also expanded during 2006 modifications.

ACCOMMODATION: Two persons in tandem with individual canopies.

SYSTEMS: Electrical system 12 V; main and standby batteries. Hydraulic handpump, operating at 103 bar (1,500 lb/sq in) for landing gear actuation and movement of louvres between VTOL and horizontal flight mode.

DIMENSIONS, EXTERNAL:

Wing span	6.10 m (20 ft 0 in)
Length overall	6.10 m (20 ft 0 in)
Height overall	2.13 m (7 ft 0 in)
Propeller diameter	2.39 m (7 ft 10 in)

WEIGHTS AND LOADINGS (Mazda engine):

Weight empty	570 kg (1,256 lb)
Max T-O weight	907 kg (2,000 lb)
Max power loading	2.43 kg/kW (4.00 lb/hp)

PERFORMANCE (estimated):

Max level speed	243 kt (451 km/h; 280 mph)
Cruising speed at 60% power	217 kt (402 km/h; 250 mph)
Max rate of climb at S/L	914 m (3,000 ft)/min
Service ceiling	7,620 m (25,000 ft)
Range	1,000 n miles (1,852 km; 1,150 miles)

ARION

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CEO: Peter Krotje

PRODUCTION MANAGER: Nick Otterback

Company founders built Kolb, Titan, Vans and Vol Mediterrani light aircraft kits before combining the best features of these in the Lightning. Arion is named for Hercules' horse. The prototype Lightning flew in March 2006 and production began simultaneously.

PROGRAMME: Partly complete prototype exhibited at AirVenture, Oshkosh, in July 2005. First flight (N233AL) 3 March 2006; public debut at Sun 'n' Fun, Lakeland, Florida, 4 April 2006. First customer-built aircraft entered factory-assist centre in March 2006.

COSTS: Kit USD29,900, less engine, propeller and instruments (2006).

DESIGN FEATURES: Optimised for both US Experimental and LSA categories; goals included generous safety and strength margins; simplicity of kit assembly; high performance; and good flying qualities.

Resembles Vol Mediterrani Esqual, but with detail refinements, including revised canopy and rudder horn balance.

FLYING CONTROLS: Conventional and manual. Horn- and mass-balanced rudder; piano-hinged elevators without tabs; mass-balanced ailerons. Slotted flaps; electrically actuated. All controls actuated by pushrods.

STRUCTURE: Moulded glass fibre on 4130 steel frame; major components joined by bolts.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring tubular steel cantilever mainwheel legs; hydraulic brakes. Trailing link nosewheel; cantilever-sprung. Main tyres 5.00-5; nose 4.00-4. Optional speed fairings.

POWER PLANT: One 89.5 kW (120 hp) Jabiru 3300 flat-six, typically driving a Sensenich two-blade, composites, ground-adjustable pitch, scimitar propeller. Fuel in two wing tanks, combined capacity 87 litres (23.0 US gallons; 19.2 Imp gallons). Alternatively, 59.7 kW (80 hp) Jabiru 2200 in homebuilt LSA category.

ARION LIGHTNING

TYPE: Side-by-side kitbuilt.



Arion Lightning at its public debut in April 2006 (Paul Jackson)

1037971

ACCOMMODATION: Two persons, side-by-side beneath single-piece, forward-hinged canopy/windscreen; rear side windows.

EQUIPMENT: BRS-5 1350 ballistic recovery parachute.

DIMENSIONS, EXTERNAL:

Wing span	8.53 m (28 ft 0 in)
Wing aspect ratio	8.6
Length overall	6.10 m (20 ft 0 in)
Height overall	1.98 m (6 ft 6 in)

DIMENSIONS, INTERNAL:

Cockpit max width	1.11 m (3 ft 7 3/4 in)
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AREAS:

Wings, gross	8.45 m ² (91.0 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	336 kg (740 lb)
Max T-O weight	598 kg (1,320 lb)

Max wing loading	70.0 kg/m ² (14.51 lb/sq ft)
Max power loading	6.70 kg/kW (11.00 lb/hp)

PERFORMANCE (estimated):

Never-exceed speed (VNE)	180 kt (334 km/h; 208 mph)
Max level speed	165 kt (306 km/h; 190 mph)
Manoeuvring speed	122 kt (225 km/h; 140 mph)
Cruising speed	152 kt (282 km/h; 175 mph)
Stalling speed: flaps up	49 kt (91 km/h; 56 mph)
flaps down	40 kt (73 km/h; 45 mph)
Max rate of climb at S/L	366 m (1,200 ft)/min
T-O run	96 m (315 ft)
Landing run	153 m (500 ft)
Range, with reserves	521 n miles (965 km; 600 miles)
Endurance	4 h
g limits	±5

ASII

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ASII was founded in 1990. North and South American markets are covered by US office.

ASII ULTRASPORT 254 and 331

TYPE: Single-seat ultralight helicopter kitbuilt.

PROGRAMME: Prototype (254 version) first flight 24 July 1993 and publicly displayed at Oshkosh that year. Two prototypes built and tested. Prototype 331 (N331UV) first flew December 1993. LBA certification was expected by early 2002: version is only marketed in countries where ultralight helicopters are regulated to company's satisfaction. In late 2002, it was announced that Huzhou Taixing Aviation Technology of Huzhou, China was producing helicopters from kits, including examples of Ultrasports.

CURRENT VERSIONS: Designations reflect empty weight in pounds.

Ultrasport 254: Single-seat, ultralight to FAR Pt 103.

Ultrasport 331: Initial experimental category version to FAR Pt 21.191(g); single-seat 'growth' model. Meets FAA 51 per cent amateur-built kit rules.

Ultrasport 331H: With 48.5 kW (65 hp) Hirth H32 added to range in 2003 and replaces the Ultrasport 331.

CUSTOMERS: Total of 70 single-seaters sold by end 2002, of which more than 50 were flying (latest information received).

COSTS: 254: USD35,000; 331: USD38,000 (2006).

DESIGN FEATURES: Design objective of 254 was basic weight not to exceed 115 kg (254 lb) in order to comply with FAR Pt 103. Two-blade composites construction main rotor with tip weights for momentum conservation in event of engine failure, 8° linear twist and infinite life; shielded two-blade tail rotor; tailplane with fins at tip; tail rotor drive carried in narrow streamlined tailboom. Centrifugal sprag clutch for starting engages rotors at 2,000 engine rpm and automatically disengages in the event of engine failure. Quoted build time 300 hours. Broad (2.44 m; 8 ft 0 in) skid track helps to prevent rollovers.

FLYING CONTROLS: Conventional collective, cyclic and yaw pedals. Floor-mounted cyclic option available since 1998; early models had top-mounted stick.

STRUCTURE: Generally of epoxy resin, graphite fabric and Nomex honeycomb; aluminium tailboom.

LANDING GEAR: Composites covered aluminium-honeycomb core legs with aluminium tube skids and steel skid shoes stressed for landings at up to 2.5 g; floats (weight 18 kg; 40 lb) optional.

POWER PLANT: 254: One 41.0 kW (55 hp) Hirth 2703 dual-carburettor two-stroke engine with pull starter and 12:1 planetary transmission. Normal fuel capacity 19 litres (5.0 US gallons; 4.1 Imp gallons).

331: One 48.5 kW (65 hp) Hirth 2706 dual-carburettor two-stroke engine with electric starter (also option for 254) or Hirth H32 of same power in 331H; 12:1 planetary transmission. Fuel capacity 38 litres (10.0 US gallons; 8.3 Imp gallons).

ACCOMMODATION: Single seat partially enclosed (254 version); enclosed (331 version).

SYSTEMS: Electrical: 12 V battery; 14 V alternator fit appropriate to engine.



ASII Ultrasport 331 single-seat ultralight helicopter with doors removed (Paul Jackson) 0110714

AVIONICS: Customer choice.

DIMENSIONS, EXTERNAL:

Main rotor diameter	6.40 m (21 ft 0 in)
Main rotor blade chord	0.17 m (6 3/4 in)
Tail rotor diameter	0.76 m (2 ft 6 in)
Tail rotor blade chord	0.05 m (2 in)
Fuselage: Length, main rotor folded	5.84 m (19 ft 2 in)
Skid track: 254, 331	2.44 m (8 ft 0 in)
331H	1.98 m (6 ft 6 in)
Height overall	2.39 m (7 ft 10 in)

DIMENSIONS, INTERNAL:

Cabin: Length	1.32 m (4 ft 4 in)
Max width	0.76 m (2 ft 6 in)
Max height	1.50 m (4 ft 11 in)

AREAS:

Main rotor disc	32.2 m ² (346.4 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty: 254	114 kg (252 lb)
331	150 kg (330 lb)
Max T-O and landing weight: 254	260 kg (575 lb)
331	294 kg (650 lb)

PERFORMANCE:

Max level speed: 254	55 kt (101 km/h; 63 mph)
331	90 kt (167 km/h; 104 mph)
Cruising speed: 254, 331	55 kt (101 km/h; 63 mph)
Max rate of climb at S/L	305 m (1,000 ft)/min
Service ceiling	3,660 m (12,000 ft)
Hovering ceiling: IGE	3,290 m (10,800 ft)
OGE	2,135 m (7,000 ft)
Range, normal fuel, 55 kt:	
254	65 n miles (120 km; 75 miles)
331	130 n miles (241 km; 150 miles)

ASII ULTRASPORT 496

TYPE: Two-seat ultralight helicopter kitbuilt.

Details as for 254 and 331, except as follows:

PROGRAMME: Developed from the 331, the Ultrasport 496 (N496AS) first flew in July 1995. Deliveries began in April 1997.

CURRENT VERSIONS: **Ultrasport 496:** Original version; no longer available.

Ultrasport 496RT: Announced 2002. Uses 84.6 kW (113.4 hp) Rotax 914 turbocharged engine with electric start and quadruple carburetors.

Ultrasport 496H: Replaced original 496 in late 2002; as described.

Sportscopter 600: New Zealand assembly; initial four registered in July 1999.

Vigilante: Remotely piloted version developed by Science Applications International Corporation (SAIC). **Vigilante 496** prototype (N496UV) evaluated as optionally piloted vehicle (OPV) by US Navy during first and second quarters of 1998. Improved **Vigilante 502** is UAV only. Further details in *Jane's Unmanned Aerial Vehicles and Targets*.

CUSTOMERS: By end 2001, 135 had been delivered of which 35 were then flying. No further information received.

COSTS: 496 USD62,900; 496RT USD77,900 (2006).

DESIGN FEATURES: Generally as for 254/331. Quick-build kit quoted build time 80 hours; dual controls standard.

STRUCTURE: Infinite-life composites rotor blades and fuselage. Shaft-driven four-blade composites tail rotor. Vertically mounted direct-drive helical spur gears 11:1 two-stage main transmission.

LANDING GEAR: Aluminium skids; track as for 254/331. Floats optional.

POWER PLANT: Original model had one 85.8 kW (115 hp) Hirth F30 quad-carburettor engine with electric starter; 75.0 kW (101 hp) Hirth H30E version designated 496H demonstrated at Sun 'n' Fun 2002 and has now supplanted F30. Fuel capacity 67 litres (17.6 US gallons; 14.7 Imp gallons).

EQUIPMENT: Ballistic parachute under consideration.



Two-seat Ultrasport 496 (Paul Jackson) 1159756

DIMENSIONS, EXTERNAL:	
Main rotor diameter	7.01 m (23 ft 0 in)
Main rotor blade chord	0.17 m (6¾ in)
Tail rotor diameter	0.76 m (2 ft 6 in)
Tail rotor blade chord	0.05 m (2 in)
Length, blades folded	6.02 m (19 ft 9 in)
Height	2.51 m (8 ft 3 in)
Width overall	2.21 m (7 ft 3 in)
DIMENSIONS, INTERNAL:	
Cabin: Length	1.35 m (4 ft 5 in)
Max width	1.22 m (4 ft 0 in)
Max height	1.50 m (4 ft 11 in)
AREAS:	
Main rotor disc	38.60 m² (415.5 sq ft)

ATAC

AMERICAN TACTICAL AIRCRAFT CONSULTANTS

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Tel: (+1 920) 572 06 59

OWNERS:

Don Friebe
Peter Lipa

ATAC, a small group of private businessmen and aviation enthusiasts, adapted a UAV design to meet requirements of the new Light Sport Airplane category introduced in 2004.

ATAC PATRIOT II

TYPE: Two-seat lightplane.

PROGRAMME: Unregistered prototype (later registered N2005M) displayed at AirVenture, Oshkosh, July 2005. Flying by April 2006. Design optimisation and certification by Aircraft Designs Inc.

COSTS: USD34,900 (2005).

DESIGN FEATURES: Able to accept variety of engines without structural change or alteration of CG. Wings removable in 10 minutes. Meets LSA and Experimental rules.

Constant-chord wing mounted high at rear of cockpit pod and above pusher power plant; empennage, including twin fins, mounted on two open booms. Wing and engine support struts normal to airflow are of streamlined section; other tubes are circular.

FLYING CONTROLS: Conventional and manual. Piano-hinged rudders with mass balance; two elevator tabs, one of which droops when flaperons deployed to counter pitch trim; other acts in standard fashion. Optional electrically actuated full span flaperons droop 15 and 25°.

WEIGHTS AND LOADINGS:

Weight empty: 496H	272 kg (600 lb)
496RT	299 kg (660 lb)
Max T-O and landing weight: 496H	512 kg (1,130 lb)
496RT	499 kg (1,100 lb)

PERFORMANCE (at max T-O weight, ISA):

Never-exceed speed (VNE)	90 kt (167 km/h; 104 mph)
Max cruising speed	61 kt (113 km/h; 70 mph)
Max rate of climb at S/L	305 m (1,000 ft)/min
Hovering ceiling: IGE	3,290 m (10,800 ft)
OGE	2,135 m (7,000 ft)
Range	130 n miles (240 km; 149 miles)
Endurance	3 h

STRUCTURE: Fuselage of welded 4130 steel tube with 0.020 gauge aluminium skins on empennage. Wings all-aluminium, with back-to-back C-channel 0.025 gauge webs and caps for main spar; 1.5 tube rear spar; 0.016 ribs; and 0.020 skin.

LANDING GEAR: Tricycle type; fixed. Castoring nosewheel and mainwheels on individual cantilever-sprung metal tube legs. Mainwheels 6.00-6; nosewheel 11x4.00-5. Cable operated brakes.

POWER PLANT: One piston engine (Suzuki 1300 inline four-cylinder with Raven reduction gear as factory standard) between 63.3 kW (85 hp) and 85.8 kW (115 hp), driving a pusher propeller; larger engine under consideration. Fuel capacity 68 litres (18.0 US gallons; 15.0 Imp gallons).

ACCOMMODATION: Two persons, side by side; door each side of cockpit. Accommodation heated and ventilated.

DIMENSIONS, EXTERNAL:

Wing span	8.84 m (29 ft 0 in)
Wing aspect ratio	6.0
Length overall	6.10 m (20 ft 0 in)

AREAS:

Wings, gross	13.01 m² (140.0 sq ft)
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WEIGHTS AND LOADINGS:

Weight empty	315 kg (695 lb)
Max T-O weight	596 kg (1,315 lb)

PERFORMANCE (85.8 kW; 115 hp engine, estimated):

Never-exceed speed (VNE)	129 kt (239 km/h; 149 mph)
Cruising speed	120 kt (222 km/h; 138 mph)
Stalling speed: flaps up	44 kt (81 km/h; 50 mph)
flaps down	39 kt (71 km/h; 44 mph)
Max rate of climb at S/L	457 m (1,500 ft)/min
T-O run	107 m (350 ft)
Landing run	92 m (300 ft)
g limits	±6



Prototype ATAC Patriot II (Paul Jackson)

1159757

ATG

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VICE-PRESIDENT, ENGINEERING: Dr Robert S Wolf

VICE-PRESIDENT, OPERATIONS AND CHIEF TEST PILOT: Robert Fuschino

DIRECTOR, MARKETING: Bob Uhle

MANAGER, PROGRAMME: George Bullard

COMMUNICATIONS MANAGER: Sara Newton

Aviation Technology Group was formed in 1998 to develop the ATG Javelin two-seat jet; it was incorporated in June 2000. Lease of 5,200 m² (56,000 sq ft) assembly facility at Front Range Airport, Colorado, announced August 2005

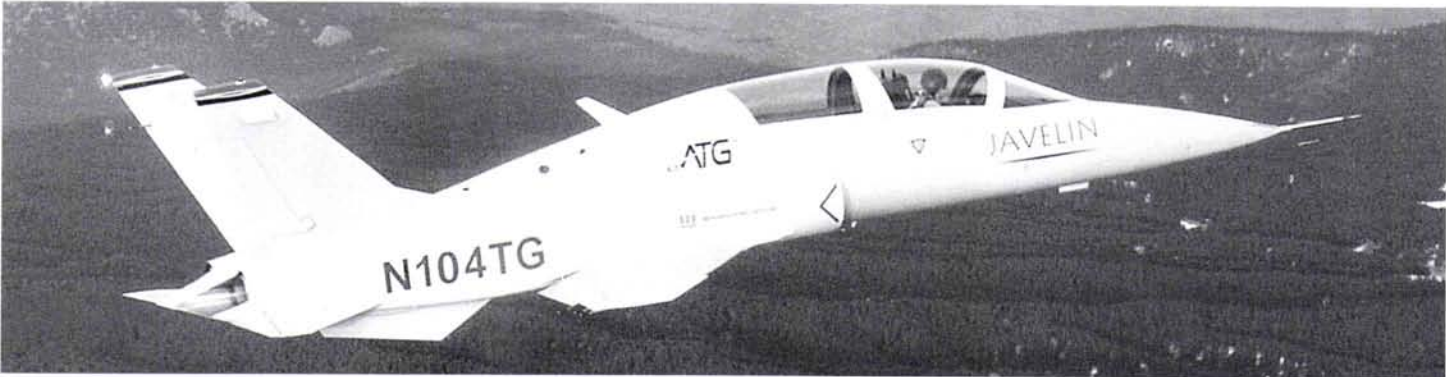
Company 10 per cent owned by Israel Aircraft Industries, which has rights to develop and market Mk 20 and 30 versions of Javelin.

ATG-1 JAVELIN

TYPE: Two-seat jet sportplane.

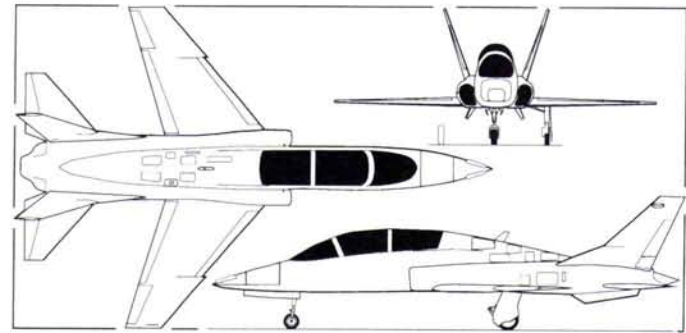
PROGRAMME: Announced early 2001, at which time initial wind tunnel testing was being undertaken; this finished 28 February 2001. Construction of full-scale, non-flying mockup being undertaken during mid-2001. A second series of wind tunnel tests was completed in late 2001 and 2002. One (N104TG) non-conforming and two conforming prototypes to fly 1,400-hour test programme. N104TG rolled out 5 May 2005; first flight 30 September 2005; total of three flights completed by end of December 2005, during which the prototype had reached a maximum speed of 185 kt (343 km/h; 213 mph) with landing gear down, at altitudes up to 4,267 m (14,000 ft), and bank angles up to 45°. First flight with retraction of landing gear took place on 28 February 2006. By July 2006 the prototype had been flown at bank angles up to 450 and reached a maximum speed of 335 kt (620 km/h; 385 mph) and a maximum altitude of 6,096 m (20,000 ft).

Design refinements announced June 2006 for production version included additional 0.56 m (1 ft 10 in) wing span and 2.69 m² (29.0 sq ft) area; addition of Fowler flaps and leading edge flaps for up to 7 kt (13 km/h; 8 mph) decrease in stalling speed; rear-hinged



ATG-1B Javelin prototype during its first flight with landing gear retracted

1159207



Current configuration of ATG-1B Javelin (Paul Jackson)

1159827

canopy with electric actuation. Certification to FAR Pt 23 Amdt 52 (Aerobatic) and first deliveries intended October 2007. Target production 10 in 2007; 70 in 2008; 120 in 2009.

At the NBAA Convention in Las Vegas on 18 October 2004 ATG and Israel Aircraft Industries announced a strategic co-operation agreement for the design development and manufacture of the AJT variant, with IAI investing equity and matching funds in ATG and final assembly of the AJT to take place in the USA and Israel as part of an integrated system for advanced and lead-in pilot training that will include flight simulators, ground-based systems, maintenance and logistics infrastructures. Initial target is Israel Defence Force/Air Force requirement for replacement of Fouga Magister (IAI Tzukit) and advanced trainer versions of A-4 Skyhawk.

All data are provisional.
CURRENT VERSIONS: **ATG-1A:** Initial design. Mid-wing configuration and separate windscreen. Replaced by ATG-1B.

ATG-1B Javelin: Mockup unveiled 12 July 2002 and shown at NBAA Convention, Orlando, Florida, in September 2002. Low wing with leading-edge 'dog-tooth' and two-piece canopy. Several subvariants:

- Javelin Mk 5 Scout:** Basic civil version.
- Javelin Mk 10:** Civil version.
- Javelin Mk 20:** Military trainer version.
- Javelin Mk 40 HDI:** (Homeland Defense Interceptor) Single-seat version armed with pylon-mounted AIM-9 Sidewinder or air-to-air Stinger missiles, was announced in early 2002. Quoted maximum speed of M1.6.
- Javelin Mk 30 AJT:** (Advanced Jet Trainer) Two-seat version equipped with ejection seats and head-up displays to complement Javelin HDI.
- Javelin Mk 50 UCAV:** Unmanned combat version announced in July 2002.

CUSTOMERS: Production forecasts range from 711 to 1,638 units (2002 estimate). Deposits (US\$25,000 each) taken on 26 aircraft by July 2002. By October 2004, the company had five distributorships (of intended six in USA) and orders for more than 80 aircraft, including 12 received during the NBAA Convention in Las Vegas that month, representing planned production until the end of 2007. Total 83 ordered by April 2005, comprising 75 from private owners and eight Mk 20s to be operated by EADS on behalf of French Navy; further seven and eight orders, respectively, then "pending".

COSTS: USD2.795 million (2005) including type rating course, plus tax. Development costs estimated at USD120 million up to certification. HDI version provisionally costed at under USD10 million; military trainer USD5.5 million. Direct operating cost USD542 per hour for basic trainer and USD700 per hour advanced trainer (2005).

DESIGN FEATURES: Extensive use of aluminium provides optimum strength to weight ratio. FLYING CONTROLS: Conventional hydraulic and manual reversionary mode, initially with sidestick, but central column adopted from July 2006. Fowler flaps. Electrically trimmed slab-type stabiliser and twin 20° outward-canted vertical stabilisers. Leading-edge slats.

STRUCTURE: Fuselage of modular aluminium structure with swept cantilevered aluminium wing with leading edge root extensions. Quarter-chord sweep: wings 33° 10'; tailplane 37° 0'; fins 41° 0'. Sweptback tail: two aft body strakes. Announced suppliers include: ATK

(fuselage structure); Applied Composite Technologies (wings, tail unit and control surfaces); Dukes Inc (cabin pressurisation control system); Mecaer (landing gear); Mecaplex (windscreen and canopy); Meggitt Thermal Systems, (environmental control and inlet de-icing systems); Northcoast Technologies (electrothermal airframe ice protection); and Parker Hannifin Corporation, (flight controls actuation).

LANDING GEAR: Hydraulically operated retractable tricycle type with oleo-pneumatic trailing-link struts. Michelin tyres. Anti-skid brakes.

POWER PLANT: Two Williams International FJ33-4-17M turbofan engines, each 8.00 kN (1,800 lb st). Prototype fitted with 6.67 kN (1,500 lb) FJ33-15M engines. Fuel capacity 1,060 litres (280 US gallons; 233 Imp gallons).

ACCOMMODATION: Pilot and passenger in tandem. Dual controls. Max cabin pressure differential 0.57 bar (8.3 lb/sq in). Maintains 2,440 m (8,000 ft) at 13,716 m (45,000 ft). Air conditioning standard. Rear-hinged canopy with integral explosive cords. Canopy sill line to be lowered by 10 cm (4 in) on production aircraft to improve downward visibility and cockpit access.

SYSTEMS: Combination of de-icing/anti-icing systems is planned: electro-expulsive de-icing for wings, bleed air heat for engine inlets, electric de-icing for windscreen and electric anti-icing for probes.

AVIONICS: Full IFR capability with three EFIS displays for PFD, MFD and EICAS functions. Options include head-up display and airborne video camera systems.

- Comms:** VHF/UHF radios; Mode S transponder.
- Radar:** Colour weather radar.
- Flight:** E-TCAS, TAWS, TCAS, EGPWS and GPS integrated FMS with waypoint map. Three axis autopilot.

Instrumentation: Avidyne FlightMax Entegra two-tube EFIS comprising one PFD and one MFD, each 264 mm (10.4 in), in each cockpit.

DIMENSIONS, EXTERNAL:	
Wing span	7.65 m (25 ft 1 in)
Wing aspect ratio	4.2
Length overall	11.27 m (37 ft 0 in)
Height overall	3.20 m (10 ft 6 in)
Tailplane span	4.27 m (14 ft 0 in)

DIMENSIONS, INTERNAL:	
Cockpit max width	0.91 m (3 ft 0 in)

AREAS:	
Wings, gross	13.84 m ² (149.0 sq ft)
Horizontal tail	3.25 m ² (35.00 sq ft)
Vertical tail (each)	3.96 m ² (42.60 sq ft)

WEIGHTS AND LOADINGS:	
Weight empty	2,111 kg (4,655 lb)
Max baggage weight	91 kg (200 lb)
Max fuel weight	850 kg (1,875 lb)
Max T-O weight	3,130 kg (6,900 lb)
Max wing loading	226.1 kg/m ² (46.31 lb/sq ft)
Max power loading	195 kg/kN (1.92 lb/lb st)

PERFORMANCE (Javelin Mk 10):	
Never exceed speed (VNE)	M0.96
Max level speed at FL350	M0.87/500 kt (926 km/h; 575 mph)
Econ cruising Mach No. at FL450	0.75
Approach speed:	98 kt (181 km/h; 113 mph) IAS
at max T-O weight	120 kt (222 km/h; 139 mph)
at typical landing weight	105 kt (194 km/h; 120 mph)
Stalling speed, landing gear and flaps down	98 kt (182 km/h; 113 mph)
Max rate of climb at S/L	2,743 m (9,000 ft)/min
Time to FL410	17 min
Max certified altitude	13,716 m (45,000 ft)
T-O run	610 m (2,000 ft)
T-O to 15 m (50 ft)	1,220 m (4,000 ft)
Landing run at MLW	1,037 m (3,400 ft)
Landing run at MLW	732 m (2,400 ft)
Range with max fuel, IFR reserves, at M0.80	1,000 n miles (1,852 km; 1,150 miles)
Endurance with max fuel	3 h 30 min
g limits	+6/-3

ATI

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ATI was incorporated in 2003 to develop its RT-700 twin-prop business aircraft.

ATI RT-700

TYPE: Business twin-prop.
PROGRAMME: In development since 2003. Launch funding being sought in late 2006.
CUSTOMERS: First order placed 18 April 2005 by US-based customer.
DESIGN FEATURES: Three-surface design with unswept foreplane and mainplane, sharply swept tailplane.
FLYING CONTROLS: Conventional and manual.
LANDING GEAR: Retractable tricycle type.
POWER PLANT: Originally proposed with two 261 kW (350 hp) Teledyne Continental TSIOL-550 liquid-cooled piston engines, with FADEC, mounted in pusher configuration. Diesel/Jet



Computer-generated image of ATI RT-700 twin-piston business aircraft

1158846

A-fuelled engine of same power had been adopted as standard by late 2006. Max usable fuel capacity 606 litres (160 US gallons; 133 Imp gallons).

ACCOMMODATION: Two crew and typical layout for four passengers in club configuration on 25 g reclining leather seats with fold-out work tables; refreshment/entertainment centre, seat-belted lavatory, and fore and aft flight-accessible baggage stowage, standard. Airbags

optional. Cabin pressurised. Four cabin windows per side, with door on port side, aft of cockpit.

SYSTEMS: Aircraft recovery system (ARS) optional.

AVIONICS: EFIS cockpit standard, comprising two PFDs and one MFD. GPS/nav/com. Mode S transponder, engine monitoring systems, and autopilot, with mechanical standby instruments, GPWS, TCAS and weather radar optional. Systems from Avidyne, Chelton, Garmin and Honeywell under consideration in 2005.

DIMENSIONS, EXTERNAL:

Wing span 11.87 m (38 ft 11½ in)
Length overall 10.41 m (34 ft 2 in)
Height overall 3.86 m (12 ft 8 in)

DIMENSIONS, INTERNAL:

Cabin: Length 4.27 m (14 ft 0 in)
Max width 1.42 m (4 ft 8 in)
Max height 1.37 m (4 ft 6 in)

WEIGHTS AND LOADINGS:

Weight empty 1,612 kg (3,554 lb)
Max T-O weight 2,585 kg (5,699 lb)
Max power loading 4.96 kg/kW (8.14 lb/hp)

PERFORMANCE (estimated):

Max speed at FL250 281 kt (520 km/h; 323 mph)
Cruising speed at FL250 273 kt (506 km/h; 314 mph)
Econ cruising speed 243 kt (450 km/h; 280 mph)
Stalling speed, flaps down 71 kt (132 km/h; 82 mph)
Max rate of climb at S/L 610 m (2,000 ft)/min
T-O field length 427 m (1,400 ft)
Landing run 412 m (1,350 ft)
Range with reserves 1,308 n miles (2,422 km; 1,505 miles)

AVEOTECH

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Aveo USA, a division of AveoTech, holds marketing rights to the Polish-built Aero AT-3 in all countries except the UK, and US rights to the Flytalia MD3 SportRider; the latter receiving certificate of LSA compliance on 16 September 2005. The company has also announced that it is designing a two-seat LSA-compliant amphibian, the AveoFreedom.

AVEOTECH AVEO X, XT and XTC

TYPE: Side-by-side ultralight/kitbuilt.

PROGRAMME: Version of Aero AT-3, manufactured in Poland, for US LSA category. Marketing launched at Sun 'n' Fun, Lakeland, Florida, April 2004, following delivery of US demonstrator (N55XT) in previous month. The aircraft was subsequently withdrawn, but promotion was continuing in 2006.

CURRENT VERSIONS: **AveoSport**: LSA/Sport Pilot version, later redesignated AveoXT, as described.

AveoX: Kit version, MTOW increased to 582 kg (1,283 lb), as for AT-3, but with upturned wingtips of AveoXT.

AveoXTC: AT-3 (span 7.55 m; 24 ft 9½ in) marketed in US under JAR-VLA bilateral certification agreement with Poland.

CUSTOMERS: Early sales of US versions included one to Venezuela.

COSTS: AveoXT USD95,000; AveoXTC USD69,500; AveoX kit USD25,000, or USD37,000 fast-build or USD49,000 with builder's assistance less engine and instruments (2005).

DESIGN FEATURES: Low-mounted, constant-chord wing with upturned tips; sweptback fin with significant (Pottier-type) rudder undercut for tailplane travel. Forward-hinged, single-piece canopy.

FLYING CONTROLS: Manual. All-moving tailplane with anti-balance tab and horn-balanced rudder. Split flaps; max deflection 40°.

STRUCTURE: Primarily metal, with some composites fairings, including wingtips and engine cowlings.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted, cantilever sprung mainwheel legs and levered suspension nosewheel with rubber-in-compression shock absorber. Wheel speed fairings.



First US-registered AveoTech AveoSport at Sun 'n' Fun, April 2004

(Paul Jackson)

0576838

POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912S flat-four driving an Aveo Sail three-blade propeller (GT-2 optional). Fuel tank ahead of cockpit, capacity 70 litres (18.5 US gallons; 15.4 Imp gallons).

DIMENSIONS, EXTERNAL:

Wing span 8.08 m (26 ft 6 in)
Length overall 6.25 m (20 ft 6 in)
Height overall 2.23 m (7 ft 3¾ in)

WEIGHTS AND LOADINGS:

Weight empty 318 kg (700 lb)
Max T-O weight 558 kg (1,232 lb)

PERFORMANCE:

Never-exceed (VNE) and max cruising speed 115 kt (213 km/h; 132 mph)
Cruising speed 108 kt (200 km/h; 124 mph) IAS
Stalling speed, flaps down 44 kt (82 km/h; 51 mph)
Max rate of climb at S/L 274 m (900 ft)/min
T-O and landing run 183 m (600 ft)
Range with max fuel 460 n miles (851 km; 529 miles)

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PRESIDENT: Mark Ward

CHIEF DESIGNER: David Saunders

Long established as a provider of aer space services and products, AviaDesign announced its A-16 Sport Falcon in 2005. Its chief designer had earlier been responsible for the Saunders ST-27 twin-turboprop modification of the de Havilland D.H.114 Heron.

AVIADESIGN A-16 SPORT FALCON

TYPE: Two-seat lightplane.

PROGRAMME: Prototype (N166SF) exhibited and announced at Sun 'n' Fun April 2006, by which time had flown twice on unspecified dates. Deliveries then expected to begin in September 2006.

DESIGN FEATURES: Conforms to US LSA criteria. Low-drag configuration with easy cockpit access, spacious interior and good view. Constant-chord, parasol wing with dihedral outboard of narrow centre section and upturned tips; single, streamlined bracing strut each side; pusher propeller above tailboom; sweptback fin and low tailplane.

FLYING CONTROLS: Conventional and manual. Split flaps, electrically actuated. Aerodynamic- and mass-balanced rudder; horn-balanced, 'piano' hinged elevator without tabs.

STRUCTURE: Generally of riveted aluminium, with composites wingtips and nosecone.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring composites mainwheel legs; hydraulic brakes and wheel fairings. Steerable, levered suspension (helical spring and oleo) nosewheel with 3.50-4 tyre. Floatplane option.

POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS liquid-cooled, flat-four piston engine; driving a Prince Aircraft two-blade, carbon fibre, fixed-pitch propeller. Fuel capacity 79 litres (21.0 US gallons; 17.5 Imp gallons).

ACCOMMODATION: Two in tandem, beneath starboard-hinged, single-piece windscreen/canopy; fixed side windows for passenger at rear. Fold-down section of cockpit port side simplifies access.



Aviadesign A-16 Sport Falcon (Paul Jackson)

1037976

DIMENSIONS, EXTERNAL:	
Wing span	8.84 m (29 ft 0 in)
Wing aspect ratio	6.5
Length overall	8.23 m (27 ft 0 in)
AREAS:	
Wings, gross	11.98 m ² (129.0 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	336 kg (740 lb)
Max T-O weight	598 kg (1,320 lb)

PERFORMANCE (estimated):	
Max level speed	119 kt (220 km/h; 137 mph)
Cruising speed at 75% power	104 kt (193 km/h; 120 mph)
Stalling speed, flaps down	40 kt (73 km/h; 45 mph)
Max rate of climb at S/L	305 m (1,000 ft)/min
T-O and landing run	153 m (500 ft)
T-O to 15 m (50 ft)	275 m (900 ft)
Range	391 n miles (724 km; 450 miles)
g limits	+4.0/-2.0

AVIAT

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The Pitts Aerobatics company was acquired by Christen Industries in 1983 along with manufacturing and marketing rights for the Pitts Special aerobatic aircraft. In turn, Aviat Aircraft Inc acquired Christen Industries in 1991 and production and type certificates for the Christen range. Aviat itself was bought by Stuart Horn in December 1995 and type certificates passed to Sky International Inc on 10 January 1996. The company has acquired manufacturing rights to the 1930s/1940s Globe Swift and Monocoupe 110, but a return to production has not been pursued. Aviat delivered a total of 83 aircraft in 1998, 85 in 1999, 91 in 2000, 57 in 2001, 55 in 2002, 64 in 2003, 42 in 2004 and 47 in 2005. Factory floor area (72,000 sq ft). Workforce stood at 58 in 2002.

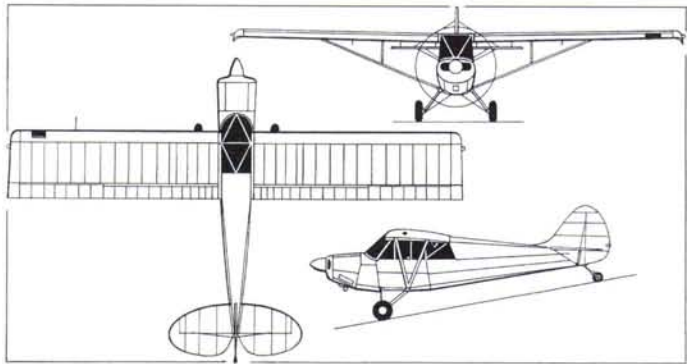


Aviat Husky A-1B with current style of balanced ailerons (Paul Jackson)

1158202

AVIAT HUSKY A-1

TYPE: Two-seat lightplane.
PROGRAMME: First flight (N6070H) 1986; FAA certification of original A-1 version under FAR Pt 23 achieved by Christen Industries 1 May 1987, this having 816 kg (1,800 lb) MTOW. Type Certificate passed to Aviat Inc, then White International on 3 December 1992, then Sky International on 10 January 1996.
CURRENT VERSIONS: **A-1:** Original version, now superseded; 398 built.
A-1A: Prototype N151E. Certified 28 January 1998, with MTOW increased by 41 kg (90 lb). Total 69 built, 1998–99 only.
A-1B: Introduced as mission-specific version initially intended for government agencies. Has higher maximum take-off weight of 907 kg (2,000 lb). Certified 28 January 1998. *Data below refer to this version.*
A-1B200: Initially designated Husky MD, First flown August 2004. Initial production aircraft (N200HY) exhibited at AirVenture, Oshkosh, July 2005. FAR Part 23 certification achieved October 2005. Features 149 kW (200 hp) Textron Lycoming IO-360 engine with dual exhausts and dual oil coolers, 2.1 m (6 ft 10 3/4 in) diameter MT two-blade composites propeller, flaps of increased span, and dynamically balanced, spadeless ailerons. Compared with standard A-1B, cruising speed at 2,286 m (7,500 ft) is increased by 8 kt (15 km/h; 9 mph) and max rate of climb at S/L is 518 m (1,700 ft)/min.
A-1B160: Introduced during 2005. Feature 119 kW (160 hp) Textron Lycoming O-360 engine 1.88 m (6 ft 2 in) diameter Sensenich fixed-pitch propeller, optional long-span flaps as on A-1B200, and dynamically balanced, spadeless ailerons. Useful load 340 kg (750 lb); max fuel range 869 n miles (1,609 km; 1,000 miles).
CUSTOMERS: Total of some 820 built by mid-2006, including 350 A-1Bs. Recent annual production of 50, 34, 37, 30 and 41 in 2001-05.
COSTS: A-1B USD139,700 (2003).
DESIGN FEATURES: Conventional high-wing monoplane; constant-chord wing with V-strut bracing and auxiliary struts; wire-braced empennage with elliptical surfaces.
Wing has modified Clark Y US 35B section; optional drooped Plane Booster wingtips and vortex generator kit.
FLYING CONTROLS: Conventional and manual. Symmetrical section ailerons with spade-type mass balance; trim tabs in elevators; slotted high-lift flaps. Fixed tailplane; trim by adjustable bungee. Control surface movements: ailerons ±20°; elevators +29/–15°; rudder ±25°; flaps 30°.
Shorter-span, wider-chord ailerons, with dynamic and mass balancing but without



Aviat Husky A-1B (2005 version) (James Goulding)

1158210

‘spades’, and longer span flaps, introduced from 2005, providing lighter stick force, increased roll rate of 30°/s and steeper rate of descent (at 244 m; 800 ft/min) for operation into short landing strips.
STRUCTURE: Tubular welded 4130 steel fuselage. Wing has two aluminium spars, metal ribs and metal leading-edge. Dacron covering overall. A-1B has 7075-T76 aluminium rear spar, replacing 6061-T6. Twin bracing struts each side of wings and wire- and strut-braced tail unit. Light alloy slotted flaps and ailerons, with Dacron covering. Fuselage and tail have chrome molybdenum steel tube frames, covered in Dacron except for metal skin to rear fuselage. Seven-coat corrosion protection.
LANDING GEAR: Tailwheel type; fixed. Two faired side Vs and half-axes hinged to lower longeron, sprung under centreline, with internal (under front seat) bungee cord shock-absorption. Cleveland mainwheels, tyres size 8.00–6 as standard; 6.00–6 or 8.50–6 tyres and 24x10–6 or 26x10.5–6 Tundra tyres optional. Cleveland mainwheel hydraulic disc brakes, toe-operated. Steerable leaf-spring tailwheel. Optional EDO 89–2000, Baumann BF-2100 and Wipline 2100 floats. Aero M1500, M1800, M2000 or M3000H wheel replacement skis. Aero wheel skis and Flairdyne hydraulic wheel-retracting skis.
POWER PLANT: One 134 kW (180 hp) Textron Lycoming O-360-A1P flat-four engine, driving a Hartzell HC-C2YK-1BF two-blade constant-speed metal propeller. MT-Propeller MTV-15B/210-58 two-blade, constant-speed, composites propeller optional and retrofitable. Fuel in two metal tanks, one in each wing, total capacity 208 litres (52.0 US gallons; 45.75 Imp gallons), of which 189 litres (50.0 US gallons; 41.6 Imp gallons) are usable. Fuel filler point in upper surface of each wing, near root.

ACCOMMODATION: Enclosed cabin seating two in tandem, on ergonomic lumbar and side support seats, with dual controls. Custom leather seats optional. Five-point safety harness. AmSafe Aviation inflatable restraints available from mid-2005. Downward-hinged door on starboard side, with upward-hinged window above. Optional skylight window in roof. A-1B has luggage door on starboard side as standard; optional on A-1A. Rear compartment for extra 13.6 kg (30 lb) baggage optional (structural provision standard) from 2000; external access starboard side, below rear window; certified retrofitting kits available.

SYSTEMS: 12 V electrical system includes lights, 22 Ah battery, and 60 A alternator.

AVIONICS: VFR standard; Loran C transponder, GPS, nav/com, intercom, and IFR instrumentation, including Garmin GNS530 GPS/com and VM 1000 panel, optional.

Instrumentation: Sensitive altimeter, ASI, magnetic compass, digital tachometer, oil temperature/pressure gauge, manifold pressure gauge and CHT gauge all standard.

EQUIPMENT: Rear seat heater and windscreen defroster standard on A-1B.

DIMENSIONS, EXTERNAL:

Wing span	10.82 m (35 ft 6 in)
Wing aspect ratio	6.9
Length overall	6.88 m (22 ft 7 in)
Height overall	2.01 m (6 ft 7 in)
Propeller diameter: Hartzell	1.93 m (6 ft 4 in)
MT	2.11 m (6 ft 11 in)

DIMENSIONS, INTERNAL:

Baggage hold volume	0.28 m ³ (10 cu ft)
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AREAS:

Wings, gross	17.00 m ² (183.0 sq ft)
Ailerons (total)	1.43 m ² (15.40 sq ft)
Trailing-edge flaps (total)	2.09 m ² (22.50 sq ft)
Fin	0.43 m ² (4.66 sq ft)
Rudder	0.62 m ² (6.76 sq ft)
Tailplane	1.48 m ² (15.90 sq ft)
Elevators, incl tabs	1.31 m ² (14.10 sq ft)

WEIGHTS AND LOADINGS (A-1B where different):

Weight empty	540 kg (1,190 lb)
Baggage capacity	23 kg (50 lb)
Max T-O weight:	
landplane	907 kg (2,000 lb)
floatplane	998 kg (2,200 lb)
Max wing loading:	
landplane	53.4 kg/m ² (10.93 lb/sq ft)
floatplane	58.7 kg/m ² (12.02 lb/sq ft)
Max power loading:	
landplane	6.76 kg/kW (11.11 lb/hp)
floatplane	7.44 kg/kW (12.22 lb/hp)

PERFORMANCE (landplane):

Never-exceed speed (VNE)	132 kt (245 km/h; 152 mph)
Max level speed	126 kt (233 km/h; 145 mph)
Cruising speed: at 75% power at 1,220 m (4,000 ft)	122 kt (225 km/h; 140 mph)
at 55% power	113 kt (209 km/h; 130 mph)
Stalling speed, flaps down:	
power on	37 kt (69 km/h; 43 mph)
power off	46 kt (86 km/h; 53 mph)
Landing speed	51 kt (94 km/h; 58 mph)
Max rate of climb at S/L	457 m (1,500 ft)/min
Service ceiling	6,100 m (20,000 ft)
T-O run, flaps down	61 m (200 ft)
T-O to 15 m (50 ft), flaps down	122 m (400 ft)
Landing from 15 m (50 ft), flaps down	244 m (800 ft)
Landing run, full flaps	107 m (350 ft)
Range: at 55% power, no reserves	695 n miles (1,287 km; 800 miles)

AVIAT HUSKY PUP A-1B

TYPE: Two-seat lightplane.

PROGRAMME: Developed as simplified, cheaper version of Husky for daytime VFR only. Prototype (N180HY) first flown 7 March 2002; public debut at EAA Sun 'n' Fun at Lakeland, Florida, in April 2002. Certification (as "engine option group" of A-1B Husky) achieved 18 August 2003, at which time a small batch of completed aircraft was being held at the factory for immediate issue to buyers. In 2005, seventh Pup (N143HP) exhibited at AirVenture, Oshkosh, with current standard of A-1B wing, including spadeless ailerons and installation of flaps; this version certified 21 October 2005 and first production aircraft (N101HY) registered January 2006.

CUSTOMERS: Three delivered in 2003, three in 2004, including one to UK, and one in 2005. Eight built by mid-2006, including two with flaps; c/ns prefixed NF or WF ('no flaps'; 'with flaps').

COSTS: USD115,000 VFR (2003).

DESIGN FEATURES: Generally as Husky.

FLYING CONTROLS: Generally as Husky, but with modified engine cowling and wingtips. Flaps deleted on initial aircraft. Flapped version has aileron movement restricted to $\pm 15^\circ 30'$; other control movements as Husky.

STRUCTURE: As Husky.

LANDING GEAR: As for Husky A-1; mainwheel size 6.00-6 (4-ply), optionally 8.00-6 (4- or 6-ply) or 8.50-6 (6-ply). Cleveland wheels and brakes.

POWER PLANT: One 119.3 kW (160 hp) Textron Lycoming O-320-D2A flat-four, driving a Sensenich 74DM6S8-0-58 two-blade, fixed-pitch, metal propeller. Fuel as for Husky.

ACCOMMODATION: Two in tandem. Optional rear compartment, as Husky.

AVIONICS: VFR panel standard.



Aviat Husky Pup with flapless wing (Paul Jackson)

1158270

Comms: Becker com, GTX 320 transponder, PM 10000 II intercom.

Flight: Garmin GPS III.

Instrumentation: ASI, altimeter, compass, digital tachometer, oil pressure/temperature gauge, EGT/CHT gauge and ammeter all standard.

EQUIPMENT: Two-colour paint scheme and polished wheel hub caps standard.

DIMENSIONS, EXTERNAL: As for Husky except:

Propeller diameter 1.88 m (6 ft 2 in)

WEIGHTS AND LOADINGS:

Weight empty	517 kg (1,140 lb)
Max T-O weight:	907 kg (2,000 lb)
Max wing loading:	53.4 kg/m ² (10.93 lb/sq ft)
Max power loading:	7.61 kg/kW (12.50 lb/hp)

PERFORMANCE:

Never-exceed speed (VNE)	133 kt (246 km/h; 153 mph)
Cruising speed	122 kt (225 km/h; 140 mph)
Stalling speed, flaps up	43 kt (79 km/h; 49 mph)
Service ceiling	5,180 m (17,000 ft)
Max rate of climb at S/L	241 m (790 ft)/min
T-O run	186 m (610 ft)
Landing run	181 m (595 ft)
Range, with reserves	869 n miles (1,609 km; 1,000 miles)
Endurance	more than 7 h

AVIAT PITTS S-2C

TYPE: Aerobatic two-seat biplane.

PROGRAMME: Developed from Pitts S-2 series of two-seat biplanes using wing design from Curtis Pitts. Uses S-2B basic structure modified with differently-shaped wingtips, empennage tips, ailerons and lower fuselage.

Pitts S-1 first flew September 1944; available only from plans until S-1S certified 13 February 1973, followed by S-1T on 24 July 1975. Two-seat S-2 added to original Type Certificate on 8 March 1971; S-2A on 11 June 1971 (205 built); S-2S 29 May 1981; and S-2B 6 April 1983. S-2C certified in Normal and Aerobatic categories on 4 June 1998.

CUSTOMERS: Total 77 built by December 2005; four delivered in 2002, three in 2003, nine in 2004 and five in 2005.

COSTS: Basic price USD194,295 (2003).

DESIGN FEATURES: Compact, positive-stagger, single-bay biplane; constant-chord wings, upper of which sweptback; wire-braced tail surfaces. Optimised for aerobatic performance. Differs from S-2B in having symmetrical ailerons; squared fin-, tailplane- and wingtips; metal fuselage undersides removable for easier maintenance. Stretch-formed compound-curved engine cowling. Rate of roll is greater than 300°/s.

Wing sections NACA 6400 series on upper wing, 00 series on lower wings. Both wings have $1^\circ 30'$ incidence and lower wing has 3° dihedral.

FLYING CONTROLS: Conventional and manual. Rudder and elevators aerodynamically balanced. Compared to S-2B, the S-2C only has a trim tab on starboard elevator. Control surface deflections: ailerons $\pm 28^\circ 30'$ – 22° ; elevator $\pm 27^\circ$; rudder $\pm 30^\circ$.

STRUCTURE: Fuselage 4130 steel tube with wooden stringers, aluminium top decking and side panels; remainder Dacron covered. Steel tube, Dacron-covered fixed tail surfaces; Dacron-covered control surfaces.

LANDING GEAR: Tailwheel type; fixed. Two faired mainwheel legs with half-axes sprung under centreline with internal bungee suspension. Mainwheels 5.00–5; tyre pressure 2.34 bar (34 lb/sq in).

POWER PLANT: One 194 kW (260 hp) Textron Lycoming AEIO-540-D4A5 flat-six driving a Hartzell HC-C3YR-1A/C7690C or E 'Claw' three-blade aerobatic constant-speed (hydraulic) composites propeller. Fuel capacity 110 litres (29.0 US gallons; 24.0 Imp gallons) of which 106 litres (28.0 US gallons; 23.3 Imp gallons) are usable; for aerobatic flight, the 19 litre (5.0 US gallon; 4.2 Imp gallon) wing tank is not used. Oil capacity 11.4 litres (3.0 US gallons; 2.5 Imp gallons).

ACCOMMODATION: Pilot and passenger in tandem under one-piece rearward-sliding canopy; single-piece windscreen. Optional replacement upper decking for single-seat operation, comprising front cockpit flush fairing and shortened canopy.

EQUIPMENT: Options include custom paint and exterior design, electronic gauges, custom parachutes, and canopy covers.

DIMENSIONS, EXTERNAL:

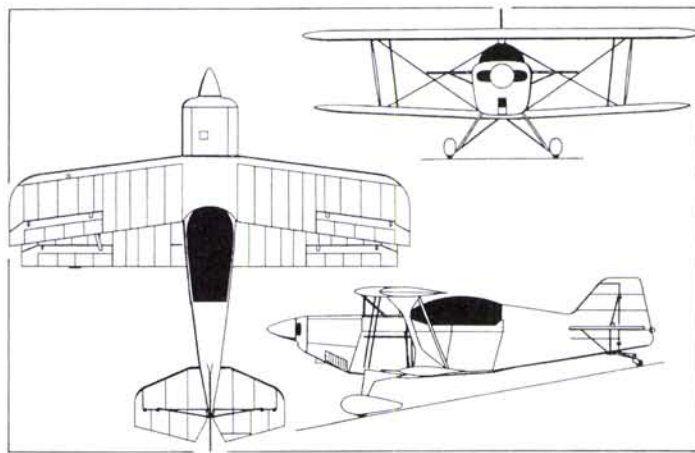
Wing span	6.10 m (20 ft 0 in)
Length overall	5.41 m (17 ft 9 in)
Height overall	1.96 m (6 ft 5 in)
Wheel track	1.54 m (5 ft 0¾ in)
Wheelbase	4.14 m (13 ft 7 in)
Propeller diameter	2.03 m (6 ft 8 in)

DIMENSIONS, INTERNAL:

Cabin: Length	2.11 m (6 ft 11 in)
Max width	0.71 m (2 ft 4 in)
Max height	1.19 m (3 ft 11 in)

AREAS:

Wings, gross	11.85 m ² (127.5 sq ft)
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Aviat Pitts S-2C (Textron Lycoming flat-six) (Paul Jackson)

1158211



Pitts S-2C flown by 20,000-hour, aerobatic pilot Fred R Cabanas (Paul Jackson)

1158203

WEIGHTS AND LOADINGS:	
Weight empty	524 kg (1,155 lb)
Baggage capacity	9 kg (20 lb)
Max T-O and landing weight	771 kg (1,700 lb)
Payload with max fuel	168 kg (371 lb)
Max wing loading	65.1 kg/m ² (13.33 lb/sq ft)
Max power loading	3.98 kg/kW (6.54 lb/hp)
PERFORMANCE:	
Never-exceed speed (VNE)	185 kt (342 km/h; 212 mph)
Max level speed	169 kt (313 km/h; 194 mph)
Manoeuvring speed	134 kt (248 km/h; 154 mph) IAS
Cruising speed at 75% power	150 kt (278 km/h; 173 mph)
Stalling speed, power off	56 kt (104 km/h; 65 mph)
Max rate of climb at S/L	884 m (2,900 ft)/min
Max roll rate	more than 300°/s
T-O run	169 m (555 ft)
T-O to 15 m (50 ft)	262 m (860 ft)
Landing from 15 m (50 ft)	366 m (1,200 ft)
Landing run	229 m (750 ft)
Max range at 75% power, 30 min reserves	246 n miles (457 km; 284 miles)
Endurance, 30 min reserves	1 h 36 min
g limits	+6/-5

AVIAT (CHRISTEN) EAGLE II

TYPE: Tandem-seat biplane kitbuilt.
PROGRAMME: Originated as rival to Pitts S-1, designed by Frank Christensen, First flown in February 1977. Kit production began October 1977, initially by Christen Industries.
CUSTOMERS: More than 350 completed and flown by mid-2001, including 320 in the United States. Promotion and production continuing in 2006.
COSTS: Kit USD85,000 (2002) less engine and propeller.
DESIGN FEATURES: Positive stagger, single-bay biplane; constant-chord wings with rounded tips, upper with sweepback; wire-braced, elliptical tail surfaces. Available in 24 individual subassemblies; quoted build time 1,822 hours.
FLYING CONTROLS: Conventional and manual. Ailerons on both sets of wings.
STRUCTURE: Fabric-covered wings with wooden spars and ribs plus metal leading- and trailing-edges. Welded 4130 steel tube fuselage, fabric covered aft of cockpit; metal panelled before.
LANDING GEAR: Tailwheel type; fixed. Fuselage-mounted, spring steel cantilever mainwheel legs with wheel fairings, Hydraulic brakes.
POWER PLANT: One 149 kW (200 hp) Textron Lycoming AEIO-360-A1D driving a Hartzell HC-C2YK-4/C7666A-2 constant-speed two-blade metal propeller. Fuel capacity 94.6 litres (25.0 US gallons; 20.8 Imp gallons), of which 90.8 litres (24.0 US gallons; 20.0 Imp gallons) are usable.



Non-standard black and gold variant of standard paint scheme applied to a UK-registered Aviat Eagle II (Paul Jackson)

1158225

ACCOMMODATION: Pilot and passenger in tandem; flown solo from rear seat. Optional single-seat upper decking assembly comprises front cockpit flush fairing and shortened canopy.	
SYSTEMS: Inverted oil system and manual fuel pump system as standard.	
DIMENSIONS, EXTERNAL:	
Wing span	6.07 m (19 ft 11 in)
Length overall	5.46 m (17 ft 11 in)
Height overall	1.98 m (6 ft 6 in)
AREAS:	
Wings, gross	11.61 m ² (125.0 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	465 kg (1,025 lb)
Max T-O and landing weight	715 kg (1,578 lb)
Max baggage weight	13.6 kg (30 lb)
Max wing loading	61.6 kg/m ² (12.62 lb/sq ft)
Max power loading	4.80 kg/kW (7.89 lb/hp)
PERFORMANCE:	
Never-exceed speed (VNE)	182 kt (338 km/h; 210 mph)
Max operating speed	159 kt (296 km/h; 184 mph)
Cruising speed	143 kt (266 km/h; 165 mph)
Stalling speed	51 kt (90 km/h; 58 mph)
Max rate of climb at S/L	640 m (2,100 ft)/min
Service ceiling	5,180 m (17,000 ft)
Max roll rate	187°/s
T-O run	244 m (800 ft)
Landing from 15 m (50 ft)	480 m (1,575 ft)
Range with 30 min reserves	380 n miles (703 km; 437 miles)
g limits	+9/-6

AVIATION DEVELOPMENT

AVIATION DEVELOPMENT INTERNATIONAL LTD

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JOINT OWNERS:
Rick Schneider
Steve Sollars

Aviation Development International was formed in 1997 to build and market the Alaskan Bushmaster kitbuilt from an earlier design by Mr Schneider. The company has a 1,486 m² (16,000 sq ft) facility at Highland County Airport, Hillsboro.
Another company product is the Loadmaster, an Aeromacchi AL-60 re-engined with a VOKBM M-14P nine-cylinder radial of 294 kW (394 hp). It was planned to convert two further AL-60s with a 560 kW (751 shp) Walter M 601 turboprop, but nothing further has become known.

AVIATION DEVELOPMENT ALASKAN BUSHMASTER

TYPE: Four-seat kitbuilt.



Aviation Development Alaskan Bushmaster (Paul Jackson)

1133259

PROGRAMME: Developed during 1980s by Alaskan bush pilot Rick Schneider to replace his Piper Super Cub. Initial design based on Merlin Explorer. Original production ceased in 1990 but restarted in 1997.
CUSTOMERS: 12 original examples and one new-build version flying by April 2001, at which time 10 further aircraft on order. One registered to Southland Holdings of Wilmington, Delaware, in July 2002; three on US register in September 2006.